JPRS-WST-85-006

11 February 1985

West Europe Report

SCIENCE AND TECHNOLOGY

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS-WST-85-006

11 February 1985

WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

ADVANCED MATERIALS

SEP OF FRANCE MANUFACTURES ITS FIRST SILICON CARBIDE FIBERS

Paris INDUSTRIES & TECHNIQUES in French 1 Oct 84 p 25

[Article by Alain Perez: "Ceramic Fibers, Incomparable in Thermomechanics"]

[Excerpts] "Sintered ceramics are much too fragile to be used in thermomechanics. This is the surest and most expensive means of making... sand." Jean-Pierre Mermillod is in charge of the industrial department at SEP (European Propulsion Company) at St-Medard-en-Jalles (33); he does not believe too much in industrial markets for sintered industrial ceramics in dynamic applications. On the other hand he puts great stock in compounds on a ceramic fiber base. In other words, fabrics made of fibers of SiC (silicon carbide) or alumina in a matrix which itself is made of silicon carbide, aluminum, or titanium. "The new materials do not find such favor with the authorities. Even when they are told that 100°C over the functioning temperature of a turbine is gained. That's too bad, because we are not starting from scratch. It would be stupid not to strengthen the experience accumulated after 10 years on carbon/carbon. The fibers are different but the densification technologies are very similar."

The first SiC fibers made by SEP will come out by the end of the year. The transformation process is complex, as in the case of carbon fiber. "We start with a precursor made of polycarbosilane. Then there is a spinning operation and heat treatment of the wire [thread]. The major problem is with the spinning. This is a very special technique. In the future, it will be necessary to create skills and to find an industrial partner."

At first, these fibers will be used to make unidirectional sheets of fabrics and rods. There is no skill problem in this field. At Villeurbanne, Fibre et Mica, already a partner of SEP in carbon fibers, will logically be involved in this project. "On the whole, ceramic compounds should be less expensive than carbon/carbon compounds. The manufacturing cycle is shorter. We can visualize civilian applications, such as cylinder head plates for combustion engines or components of turbo-engines.

There should not be too much of a problem either with the manufacturing stage that will turn out solid pieces made of SiC/SiC compounds. The technology of densification by the gaseous method has been perfected. "We decided to get into the area of infiltration by gaseous means in 1975. This process has been used on an industrial scale since 1979 for carbon/carbon compounds. The technology is similar for ceramics/ceramics."

This product line has just been started up. For the time being, Nippon Carbon is the only one that has the complete know how. The first French ceramics/ceramics compounds will furthermore be on a base of Japanese SiC fibers. "There are two solutions: Purchase the license or make the product ourselves. If France had a cruise missile program, we would have an immediate market. But it is at any rate difficult to put an industrial strategy together by falling back only on military orders. Regardless of the solution selected, we would not want to lose our know how."

Few applications will see the light of day before 1990. "There will undoubtedly be a demonstration on an aircraft engine by 1990." There are many studies in the transportation field and some of the prototypes are running. "It will be the heavy-weight vehicles that will get the first ceramicized engines. The bigger the engine, the more will sophistication turn out to be profitable." Who then will be the first European automaker to introduce ceramics/ceramics in series in the hot parts of his engines? Perhaps a German builder with whom SEP has just signed a development agreement. Around 1992.

5058
CSO: 3698/167

AEROSPACE

DECISION ON FRG PARTICIPATION IN 'COLUMBUS' BY DECEMBER

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 15 Nov 84 p 8

[Article:"Europe's Contribution for America's Space Station"]

[Text] A. J. Cologne, 14 November. Technology experts of the American Congress have characterized the Reagan-supported NASA project for erection of a permanently manned space station by 1992 as "neither scientifically nor economically justified." In a Washington published report of the Congressional Office for Technology Financing it is stated that the $8 billion estimate for the Space Station Program is "shortsighted." Yet, on the other hand, the the reproach leveled in this report with the title "Civilian Space Stations and the Future of the USA in Space" has no binding character for NASA.

Meanwhile, preparations for the development of the space station continue not only in the United States but also on this side of the Atlantic. On Tuesday, as the American congressional committee was publishing its study, at the" German Research and Test Establishment for Aeronautics and Astronautics" (DFVLR) in Cologne-Porz the specific component that the Europeans are considering contributing was being-officially presented for the first time at a special symposium.

A total of three componets are involved: first, a cabin in which the astronauts could execute scientific tasks without space suits. This "pressurized module" would be similar to that Spacelab cabin in which the first German astronaut, Ulf Merbold, worked with his colleagues in space a year ago. The second component is a platform open to the heavens upon which a telescope, measuring instruments and other equipment for space research could be installed. Finally, the third component is a "resource module." At times it would be used as an energy source for the platform and enclosed cabin; at other times it would be used as a drive element. However, initially the resource module will be attached directly to the space station and thus be dependent on the latter's energy supply.

The program for building the three European components was initiated by the FRG and Italy under the name "Columbus." The European space organization ESA (European Space Agency) is expected at the beginning of next year to finally decide whether or not it will construct "Columbus" and participate in the American Space Station Program. According to information generated by Hartmut Sachs of the DFVLR in Cologne-Porz, the cost will amount to 1.8 billion ESA accounting units (one accounting unit equals 2.23 Marks). The American space station plus the European cabin and platform is expected to be ready for use in 1992 in time for the 500th anniversary of the discovery of American by Columbus.

Of course, the Europeans are thinking about fashioning their contribution to the station in such a way that it will also provide more independence in space for Europe. Thus consideration is being given to designing the cabin so that at a later time with the aid of the then available service modules it can be further developed into a European manned space station.

Parallel to this, the French are already pressing the further development of the Ariane Rocket to Ariane 5 which is expected to be capable of placing 15-ton payloads into low earth orbits with a single launch in the 1990s. Here it is planned in certain situations to place "Columbus" in orbit not only with the American Space Transport but also with the Ariane Rocket. Alternatively, a smaller manned European space transport system could be built. To date, however, no funding is in sight for either the Ariane 5 or for continuation of European space transport developments which could cost DM 10 billion and more.

In the meantime, the eleven ESA member countries are going to have to vote on the Columbus Project. Gottfried Gregar of the Federal Research Ministry reported recently in Cologne-Porz that Bonn's final decision for or against Columbus is to be expected at the beginning of December. However, in view of the fact that Chancellor Kohl gave President Reagan a tentative yes several months ago, a negative decision is considered unlikely. Of course, the research ministry will require a fifty percent increase in its space budget for the sought participation in the American Space Station Program, an increase from about DM 800 to 1,400 million annually. As yet, neither the finance minister nor anyone else has made an offer. Bonn is expected to contribute fifty percent of the cost of the Columbus Program to the European cooperative program.

9160
CSO: 3698/119

AEROSPACE

FRG, ITALY, FRANCE, OTHERS LINE UP AS ARIANE-5 PARTICIPANTS

Paris AFP SCIENCES in French 24 Oct 84 P 14

[Article: "Ariane-5"]

[Excerpt] A Timetable That Must Be Observed

To win the challenge of "Ariane-5" for which the development of the HM-60 cryogenic engine will take place 2 and 1/2 years before that of the launcher, the timetable must be strictly adhered to.

During the next 125 months, the preliminary project will have to be refined and the development program prepared. Therefore, industrial invitations to bid will be published late in March 1985, and a proposal for the geographic allocation of industrial tasks will have to be submitted to the European Space Agency at the very beginning of 1986 in order to enable it to make a final decision on this in March 1987.

Preliminary development of the HM-60 engine should start late in 1984, so that development of the launcher could start by mid-1986. Indeed, it will take 10 years to develop the liquid oxygen and hydrogen engine, and 8 years to develop the full launcher.

As is known, by the end of this month, France, the FRG, Sweden, Italy and Belgium must make a final commitment on their final participation to the HM-60 program for which the European Space Agency has allocated initial credits amounting to 140 million accounting units.

Possible Participants

Ten European countries or so expressed their intention to participate in the launcher program proper: France, its promoter, would finance 50 to 55 percent; the FRG, 25-30 percent; Italy, about 15 percent; the United Kingdom, from 5 to 7 percent; Sweden, 5 percent; Belgium, 3 to 5 percent; Switzerland, 2 to 5 percent; Denmark, the Netherlands and Spain, each 1 to 2 percent; Norway, an amount still to be determined. Austria could join all these backers and industrial participants.

9294
CSO: 3698/205

AEROSPACE

BRIEFS

FRENCH WANT SECOND RIDE--On 11 October, we learned from a French source at the International Astronautics Congress in Lausanne, that France had made an official request to have a second French cosmonaut fly on a Soviet spacecraft and space station. The request was presented last week at a meeting of the French-Soviet commission on space cooperation, in Samarkand, Tadzhikistan. The Soviets, the source added, will consider the question but gave no indication as to what their answer would be. The first French cosmonaut, Jean-Loup Chretien, flew on board Saliut-7 in June-July 1982. His substitute, Patrick Baudry, is now being trained in Houston for a flight on board the shuttle in February 1985. The National Center for Space Studies recently issued an invitation to apply for the preselection of 10 more would-be cosmonauts. [Text] [Paris AFP SCIENCES in French 18 Oct 84 p 33] 9294

CSO: 3698/199

AUTOMOTIVE INDUSTRY

FIAT INTRODUCES 1000-CC ENGINE

Turin ATA-INGEGNIERIA AUTOMOTORISTICA in Italian Oct 85 pp 551-558

[For related article, see JPRS-WST-84-039 18 Dec 84 pp 16-19]

[Text] The FIRE 1000 is the progenitor of a new generation of FIAT automotive engines in the ± 1000-cc cylinder-capacity range.

An extremely advanced engine, both in design and in the experimental technologies embodied in it, FIRE 1000 does what it set out to achieve, to wit: extreme simplicity in construction, reduced weight, high performance, and low fuel consumption.

Design Philosophy

The name -- FIRE 1000 -- refers to the automated and highly robotized production systems, which are one of the most fascinating factors involved in the new engine's genesis. (FIRE is an acronym for "Fully Integrated Robotized Engine".)

The main advantages incorporated into the FIRE 1000 can be summed up briefly as follows:

-- Extreme simplicity in design and construction which, however, implies great technological sophistication in the planning and testing phases (use of laser holography and of the most advanced approaches in structural calculus).

-- Fewer Parts: 30 percent fewer than in the 1050 engine that powers the 127 (273 parts vs. 368).

-- Compact dimensions, resulting in very low mass (a mere 69 Kg).

-- Remarkably high performance: (a potential 33 kW at 5000 rpm, developing 80.4 Nm [Newton meters] torque at 2750 rpm).

-- Fuel economy (consumption 15 percent below best present-day levels).

-- Practically no maintenance requirements.

FIAT will build the new engine at Termoli, in Molise, in a new and highly robotized plant described as the most advanced in the world, owing to its efficiency and cutting-edge technology.

When in full production, the plant is expected to turn out 2,500 engines per day (that's three every minute).

Investment costs for the FIRE came to a total of 630 billion lire: 30 billion for design and testing, plus 600 billion for the new plant.

New Goals Dictate New Technical Approaches

Over the past 50 years, technical developments in internal combustion gasoline engine design have been few in number and minor in impact. True, from the thirties to the seventies we witnessed steady evolution in the power specifications of automotive engines, but it was attributable in part to improvements in fuels, in part to the physical/mechanical advances in materials, but almost never to new ideas aimed at making the automobile engine a more efficient device for transforming energy.

With the exception of the Wankel engine, which was summarily rejected by the vast majority of builders, one can safely say that Ricardo (born 1885) and other engineers among his contemporaries probed the problems they encountered in sufficient depth to achieve automotive engine performance levels that were more than satisfactory for their time.

This does not mean that, in the years since those days and right up to our own time there has been a decline in engineering interest in research to optimize the automotive engine. On the contrary: such engines, because they are produced in such vast numbers, are undergoing continual evolution, particularly in the areas of fuel consumption, pollution controls, reliability, and materials selection.

In our case, the precursor of our new FIRE 1000 engine was the 903-cc FIAT engine, which bears out what we have just said. Introduced in 1953 to power the history-making FIAT 600, then the 850, the 127, the Panda, and, finally, the Uno, this same engine design grew from 633 cc to 903 cc and finally to 1048 cc in the Arbath version of the little A 112, undergoing continual improvement in performance, fuel economy, and horsepower.

Even though there is still rome for innovation and improvement in conventional engine parameters (the FIRE 1000 engine is the best

evidence to that effect), the outlook for biggest improvements in engine design has to do, even so, with the industry side or, if you will, with production (both in automation and in quality).

Thirty years after the introduction of the 903 engine, it was time to start thinking about a new generation of engines for the years ahead.

This was our chance to engage in a total reconsideration of the production aspect, to devise a kind of production process that would be almost entirely automatic and make maximum use of robots to achieve higher productivity levels and consistent high quality. It turned out that the only way to do this is to design an engine specifically to be built and produced in a wholly new way.

The Design

The philosophy behind the construction planning for the FIRE 1000 engine led us to the following solutions:

-- Extensive use of cast iron

Since this is a material that can easily be worked to fine tolerances, and which over the past several years has undergone major technical advances, the following components are made of cast iron: the engine-block with its bench-caps, the crankshaft, connecting rods, distributor shaft, flywheel, valve-guides, and piston-rings.

Fewer Parts

We opted for a cam-in-head engine, with direct belt drive off the crankshaft, thereby dispensing with rods, rocker-arms, and their shafts. The oil pump is set directly atop the drive-shaft, where it also serves as front cover and support for the oil filter.

The fuel-pump is just over the cylinder-head and is driven by the camshaft.

The water pump is set into the base-plate and driven by direct belt.

This design let us scrap a whole string of gadgets usually needed to make these components work (as a rule you need an auxiliary shaft that is gear- or rotor-driven to power the oil-pump and the ignition/distributor system).

Between the 1050-cc engine in the 127, with its comparable structure, and the new FIRE 1000, the number of parts has dropped by almost 30 percent -- down from 367 to 273.

-- Fewer mechanical finishing operations

All of the outer engine-covers are die-cast, and require only minor finishing touches.

Affected first of all are the lower portions of the cylinder heads and the forward and rear crankshaft housings.

Lubrication for components atop the cylinder-head, camshaft, and tappets feeds through a small steel tube that leads the oil directly to these components, thereby avoiding the need to drill into the cylinder-head casting.

Oil reaches the engine and piston bearings through a hole drilled from the block bearing to the piston bearing, with no need for further intersecting drilling and requiring no plugs to stop the drill-holes.

Toothed gears: to drive the distributor and water-pump and for the oil-pump gears; these are stamped directly out of sinterized steel and need no machining.

Even the combustion chambers atop the cylinder head, whose dimensions and tolerances are of the utmost importance, are die-cast.

-- Major components weigh less

The FIRE 1000 engine block, despite its having five offset supports, has a mass of only 18 kilos (as opposed to the 24-kilo mass of the 903-cc engine block and the 33-kilo engine block for the 1050-cc overhead-cam engine).

Another feature is that the piston rods are unconnected with the outside structure. The two walls containing the cylinder water-jackets are confined to the portion covered by the actual length of the piston-rings' stroke, rather than running the full length of the cylinders.

The cast-iron walls are only 4mm thick. This was a daring reduction, made possible by the use of block supports, which let us use a new and extremely reliable casting system.

The cylinder-head is a single piece, completely hollow around its central support, which contains both the valve-springs and the housings for the distributor-shaft axle journals. This feature was made easier by the completely vertical positioning of the intake and exhaust valves and their alignment on a single plane.

-- Simplified construction and assembly

That one item -- fewer components -- (273 in the FIRE 1000 vs. 367 in the 1050) suffices by itself to indicate that the new engine

design has done away with the need for a good many operations. This, along with the very high level of automation on the production lines, underlies a major breakthrough: total fabrication time for the FIRE 1000 is exactly half that required for the current 903 engine. Almost the entire gamut of machining operations on the base and cylinder heads (smoothing, drilling, tapping, boring, etc.) is performed on planes set at 90-degree angles to each other.

The inside screws in the cylinder head (shuch as those that hold the manifolds in place) are "either-way" screws, meaning that there is no "wrong way" to set them.

Every screw and nut is easy of access with a straight tube-wrench.

Most of the system sub-assemblies are fool-proof, too, meaning that it is physically impossible to put them together any way but the right way.

All screws have indestructible heads.

All the conventional gaskets made of "reinforced paper" or "cork gum" have been replaced with silicon-based adhesives that can be applied by robots.

-- Maximum energy savings

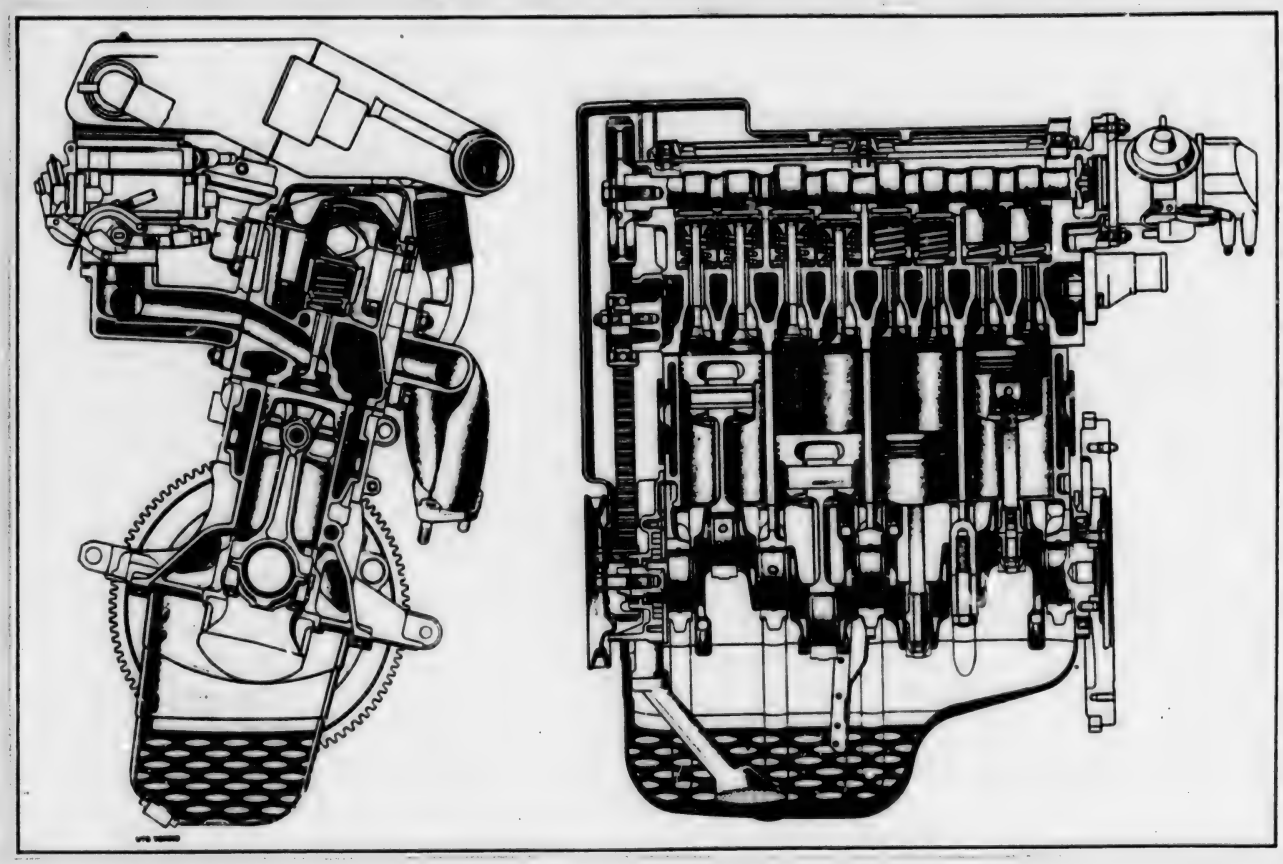
Functional to the nth degree, the FIRE 1000 engine was born to save energy. It does that, thanks to the limited number of parts and operations involved in the fabrication process, and to very miserly fuel consumption.

Any physics text on thermal machines teaches that specific fuel consumption in a given engine is totally dependent on two factors: mechanical performance and thermodynamic performance.

More specifically, the mechanical performance of an engine is best when the power dissipated in friction from its own movement and by drag from its auxiliary systems (oil-pump, water-pump, fuel-pump, generator, and ignition system) is least.

From the mechanical point of view, the greatest power waste must be charged to friction due to rubbing and rotation. Pistons rub against cylinder walls, the camshaft turns on its supports, and the piston-rods turn on their blocks.

Two major factors are behind these losses: the combination of pressure forces that occur at the first level and, above all, the forces of inertia and the peripheric or sliding velocities that, owing to the hydrodynamic phenomena they engender in the oil film, interfere with the value equation. Lowering the running-speed by 500 or 600 rpm is very good medicine for every problem that has to do with mechanical losses.



TRANSVERSE AND LONGITUDINAL SECTIONS OF THE FIRE 1000 ENGINE

Of course there is every reason to lighten parts and components, but the combination of reduced rpm and smaller diameters for rotating parts is of paramount importance in the effort to minimize mechanical losses.

These factors were crucial in the dimensional design of the main components and subassemblies for the new FIRE 1000 engine.

Its specified power (33.1 kw) is delivered at the modest rate of 5000 rpm.

That power, sufficient to the anticipated demand, made it feasible to downscale all rotating parts to dimensions compatible with minimal losses.

Block pins and piston-rod pins for the driveshaft are 44 and 38mm in diameter, respectively, vs. 50.8 and 40mm in the 903 engine, for example.

Considering the square of peripheric velocities, the combination of smaller diameters and reduced rpm implies almost a 40-percent diminution in the sources of friction.

On the other hand, even though the diameter of the block-pins has been pared, there are now five of them instead of three, and hence a 46-percent gain in support surfaces.

Lastly, engine mass has been cut from 76 to 69 kilos, a datum that puts the cast-iron FIRE 1000 on a par with light-alloy engines within its cylinder-capacity range.

A mathematical study using computer-aided design (CAD) made it possible to build a driveshaft with a mass of 5.93 kilos, whereas the 903's steel driveshaft has a mass of 7.4 kilos.

That is a 25-percent weight reduction, right there.

The piston rods in this engine are made of cast iron, but their overall mass -- rods, bearings, and nuts combined -- is exactly the same: 485 grams.

The engine block weighs only 18 kilos instead of 24. Despite larger bores (70mm vs. 65mm) it measures only 9mm longer (329 vs. 320mm). The interval between cylinder centers is constant at 77mm, whereas in the 903 the spacing was 71-73-71mm.

Lastly, engine mass has been brought down from 76 to 69 kilos.

Additional features in the FIRE 1000 engine

There are many innovations in the design of our FIRE 1000 engine. For instance, in order to protect the perfect roundness of the cylinders, we isolated the rods from the rest of the block.

Until now, conventional solid cast-iron cylinder block design meant that, on the assembly line, when the time came to tighten the screws holding the head to the block, stresses were induced at such high levels as to impair the circularity of the bore and, on top of that, affecting the several levels of the cylinders in disparate ways and to differing degrees.

This called for special care and expertise in adjusting the operating play clearances between piston-wall and rod and some resetting of piston segmentation to accommodate the non-linearity of the rod, and thereby achieve the requisite seal.

The new design of the cylinder block in the FIRE 1000 engine cushions the rods against the mechanical impact of screwing down the head, and makes it possible to maintain precise and constant diameter and circularity in the cylinders, no matter what mechanical or thermal stresses may be brought to bear.

Once we had this problem solved, we could reduce the tangential load of segmentation, while keeping low oil consumption and, of course, proper management of combustion gases.

The happy solution to the problem of protecting the geometry was to align the axes of the cylinder-head screws with the axes of the screws used to fasten the block-pin caps.

In addition, the in-head position of the camshaft frees the base from asymmetrical shocks and makes expansion control easier.

The special nature of this engine, which requires only minor variations in cylinder capacity, made it possible to select the optimum diameters for the block and rod pins, and thus reduce the peripheric velocities imposed on the bearings.

Besides, merely having freed the engine of several now-unneeded devices and having positioned everything we possibly could atop the driveshaft and camshaft greatly simplified designing the lubrication system.

The internally-toothed oil-pump is set directly on the driveshaft.

The distance the oil must travel to the five block supports is minimal. The upper components are oiled through a single vertical duct, tipped with a small steel pipe that delivers the oil to the three cam-shaft supports: a simpler and more efficacious solution.

Oil from the cylinder-head flows down to the oil pan by gravity, through six holes in the bottom of the head.

Gaskets and packing on the drive- and camshafts are of silicon adhesives, a material which affords friction levels appreciably lower than those provided by the polyacrylic adhesives now in use.

The oil- and water-pumps, too, were scaled down in such a way as to limit power absorption.

The oil and water systems were designed to insure maximum permeability, thereby avoiding the bottlenecks and complicated routing which, for both pumps, translated directly into fuel slowdowns or interruptions and hence greater power loss. Describing the decisions we made to optimize the FIRE 1000 engine's thermodynamic yield is a tad more complex.

If we rule out at the start the notion that one engine built with conventional materials can be more adiabatic than another -- that the calories passing through chamber and cylinder walls are visibly different in quantity from one case to the other, we can sum up the concept of good thermodynamic efficiency as optimization of these three parameters: combustion chamber, compression ratio, and fuel system.

Combustion chamber

The combustion chamber design, while made possible by mathematical models, is still equally the product of practical bench-testing.

The very architecture of the FIRE 1000 engine, with its parallel vertical valves, leaves little choice in the matter of combustion chambers.

To find the right one, we considered several designs: the Heron, semi-Heron, Bathtub, Masked Valve (single and double ignition), and May. We set a number of evaluation criteria, governed by the following parameters:

1. Rapidity of combustion cycle and consequent lowering of the angle of ignition advance demanded by the engine.

2. Possibility of engine operation with high compression rates and knock control.

3. Assurance that the engine would operate properly on a lean air-gas mix.

4. Control of CO_2, HC, and NOX emissions.

5. Low fuel consumption at more frequently used idling speeds.

All these qualities had to be fully compatible with the performance goals we were seeking.

Our findings pointed to opting for the so-called Bathtub design which, after judicious adjustments in a few parameters (spark-plugs, "squish" areas occurring on either the plug or the opposite side, index of turbulence in the feed at completion of compression) gave us the lowest fuel consumption found in any of the chambers tested and optimum behavior in relation to knock, even at high compression ratios.

Compression ratios

In view of the fact that this factor plays a role of paramount importance in an engine's thermodynamic performance, it is logical that we put our greatest effort into raising the FIRE 1000's compression ratio.

The prime factor working against high compression ratios is knock, but a close second is the quality of gasolines generally available on the market.

Not only does the octane rating have an importance of its own, but so does the shape of the combustion chamber and, above all, the temperature of the fuel mix delivered at the end of the compression phase.

Normally, the possible approaches for achieving this end are: lowering the angle of advance, blending in some inert gases (left over from the preceding phase, that is), and enriching the fuel.

The first solution interferes with thermodynamic performance, but affects operating performance at the knock level (low rpm, full fuel flow) to only a limited degree. Engine consumption is not adversely affected by this in most of its areas of utilization.

The second solution, normally approached by adapting the valve "overlap" angle, lowers thermodynamic performance. In addition, the engine's power curve is raised at high rpm and lowered at low rpm.

The third solution, achieved by adjusting the carburetor setting, leads to higher fuel consumption and is less flexible than the first.

It is more practical to make adjustments in the ignition law than to focus on the air/fuel ratio in the carburetor mix.

Insofar as the FIRE 1000 engine is concerned, a variation in volumetric yield big enough to trigger a shift into lower gear was not acceptable, since we preferred to offer high flexibility rather than high power at high engine speeds, since the weights and aerodynamics of present-day cars are such that the 33 Kw developed by the engine already allow more than satisfactory speeds.

As a consequence, we hit upon a compromise solution, optimizing both carburetion and the ignition law, the latter by means of attaching a clever device to the pneumatic choke control.

Thanks to these solutions and to the efficient design of the combustion chamber, we endowed the FIRE 1000 with a compression ratio of 9.8 (max. 10) to 1.

Fuel System

The fuel system, consisting of the carburetor, the intake manifold, and the air filter, is responsible not only for "feeding" the engine, but also for guaranteeing its proper operation by preparing the optimum air/gasoline mix.

The fact is that, at partial feed loads, the air warmed in the filter and in the intake manifold can blend well with misted gasoline to constitute a homogeneous compound. For its part, the carburetor must see to it that the mix it supplies is as close as possible to the "leanness" limit the engine can tolerate and still stay at its minimum level of specific consumption.

The carburetor we put into the FIRE 10000 engine is a one-piece component of new design, and it is equipped with various devices

that make it simple to control the fuel flow so as to respond with alacrity to the engine's demands insofar as concerns the sir/fuel ratio under all operating conditions. The Weber TLF carburetor is totally new in design. Its main feature is that it is attached to the top of the intake manifold with vertical screws which, passing completely through it, make it simple to install.

It consists of three parts, stacked one atop the other.

Made of aluminum, it is 30 percent lighter than the carburetor on the 903 engine. It is sturdier and more reliable, is more resistant to corrosion, and does just as well on an alcohol-gasoline blend as on conventional fuel, with no modifications.

It is designed to accept installation of a "cut-off" and other supplementary devices.

The intake manifold was designed after several tests to guarantee proper delivery of the fuel mix to the individual cylinders.

For greater efficiency, the intake manifold was equipped with, among other things, a mix-adjuster located at the point where the four branches intersect, and there are grooves in its lower portion to channel the fuel in its liquid state (or, if you will, while running cold).

Proper distribution of the mix to the cylinders has produced marked improvements not only in fuel consumption and in responce at low rpm, but also in the engine's behavior under knocking conditions.

These technical advances, coupled with obsessive attention to detail, have produced excellent levels of fuel consumption: 15 percent lower than we got from the 903 engine in the 127 FIAT, which was itself among the most miserly engines going.

However, in order to appreciate all the economies built into the FIRE 1000 engine, you have to look at the transmission and see it in relation to the car it powers.

Engine power delivered at 1000 to 2500 rpm is so high as to invite comparison with that of engines with greater cylinder capacity.

This meant that we could opt for fairly long gear ratios, thereby getting considerable reductions in fuel consumption without compromising acceleration quality, even in high gears. In fact, the "stretched-ratio" engine operates, at equal road speeds, at both higher gear ratios and lower rpm rates, all contributing to mechanical performannce and hence to lower fuel consumption, but, what is more, it does so with power to spare for eager response to the accelerator.

The FIRE engine has 100 cc of cylinder capacity, but behaves like a much bigger one, even as it holds fuel consumption at 1000-cc levels at low fuel-feeds.

The excellent power output delivered (84 Nm at 2750 rpm) can be attributed in large part to optimization of its volumetric performance in low and middle gears.

To achieve this, we conducted special research into the laws of intake- and exhaust-valve apertures, which revealed, via some very complex calculations, new ways to design our distributor shaft.

In addition, in order to increase the air-flow speed in low gear, we decided on very small dimensions for the intake and exhaust pipes, knowing that this would cut into the engine's maximum power slightly, though still leaving it more than sufficient.

It is worth repeating that this extraordinary "fuel-boost" to the engine in low gears was sought and achieved only after making sure that the engine could easily withstand the effects of knock. To get a better idea of the advances embodied in the new FIRE 1000 engine, it might be helpful to make a direct comparison between it and the world-famous 903-cc engine in the FIAT 127.

The latter's intake valves are 29.1 meters in diameter, with apertures of 7.65mm. In top gear the fuel velocity is 78 m/sec.

In the new FIRE 1000 engine, the valves measure only 30.5mm and have apertures of only 7.1mm, and, with top gear reduced from 5600 to 5000 rpm, fuel velocity is boosted to 83.6mm/sec. At full throttle, fuel velocity is 41.8m/sec at 3000 rpm in the 903, but it is 43.8m/sec at 2750 rpm in the FIRE 1000.

One final observation about fuel consumption has to do with the way the engine runs while it is warming up. Although the official EEC level for urban driving is the result of a test run on a roller-bed benchtrack that simulates city driving conditions in a warmed-up car, any motorist knows full well that, over the same distance, with the engine running cold, fuel consumption is going to be higher. This can be explained not only by the additional friction induced by the higher viscosity of the cold oil, but also and primarily by the fact that until the engine is warmed up, a richer fuel mix is needed to offset the greater density of the cold air and impaired fuel distribution, which, in turn, condenses the fuel. To reduce the time it takes to heat the mix in the manifold, the cooling system in the FIRE 1000 is so designed that, when the thermostat is off, the cooling liquid is shunted directly to the water-pump, passing only over the intake manifold, which is quickly heated.

Main Technical Features

Number of cylinders	4, in-line
Bore/stroke ratio	70 : 64.9 mm
Spacing between cylinder axes	77 mm
Cylinder capacity	999 cc
Compression ratio	9.8:1
Maximum power	33 kw at 5000 rpm
Maximum transmission	80.4 Nm at 2750 rpm
Fuel feed	1 one-piece carburetor WEBER 32 TLF/250
Ignition	Electronic, no contact with spark advance at end-cycle
Cylinder heads	Light alloy
Timing gear	1 overhead camshaft
Valves	Vertical and parallel
Ø intake	30.5 mm
Ø exhaust	27.5 mm
Valve lift	7.1 mm
Distribution diagram	
intake: open	42° before PMS
shut	60° after PMI
exhaust: open	56° before PMI
shut	18° after PMS
Cylinder-block	cast iron
N. drive-shaft supports	5
Drive-shaft	cast iron
Ø block pins	44 mm
Ø piston rod pins	38 mm

6182

CSO: 3698/182

BIOTECHNOLOGY

WORLDWIDE STATUS OF PLANT GENETIC ENGINEERING

Paris BIOFUTUR in French Nov 84 pp 21-25

[Interview with Professor Marc Van Montague; 19 July 84; place not specified]

[Excerpt] Along with Professor J. Schell, Professor Marc Van Montague directs the Plant Genetics Laboratory at the University of Ghent in Belgium. This lab specializes in plant genetic engineering and "in vitro" regeneration. He discussed with us his views on the status of research and the future of plant molecular biology.

Question: In your opinion, where is the most interesting scientific work in the area of plant genetic engineering being done, and which companies are the most advanced in this field?

Answer: With regret, I have to admit that in general, the most interesting work is not being done in the universities or in public research institutes. In the United States, the university structure and the need for an immediate return makes it hard to make headway in a new field. In Europe, the site of choice for the development of new disciplines, the economic crisis has not only blocked all university expansion programs, but has also brought about a real dismantling of government civil service staffs. Our laboratory, like the one of the Leiden group or the labs of some excellent English groups, can only continue thanks to the support we receive from industry.

Applied molecular biology has grown tremendously, primarily in the United States, through the creation of research and development companies for genetic engineering. A good number of these companies are now trying to develop a plant section. There are also a number of companies which were set up with plant research as their sole focus. But among these (I am thinking primarily of IPR and Agrigenetics), some of them are having really big problems. For on one hand, they can't expect to be able to bring out a product on the market in the immediate future, as there is still much basic research to be done. And secondly, their costs are very high because they have to establish a research staff in their companies almost equivalent to a university department. So their main problem is the still relatively not very advanced stage of their work, and the lack of good molecular biologists.

But then there are Genentech and the Genetics Institute, which are excellent genetic engineering companies. Their advances in the medical field have already earned profits for their investors. This creates a climate of confidence, and helps in getting very long-term investments.

Nonetheless, among the companies specializing in plants, the firm Native Plants in Salt Lake City, Utah, seems to me to be off to a very good start. It began to work on the micropropagation of plants which, though still a basic technique of plant genetic engineering, has already enabled the company to market some "classic" varieties. Then the firm gradually added molecular biology to its skills, working in close collaboration with the University of Utah, whose molecular biologists are excellent. If these scientists are interested in plants, they will be able to do some very interesting work. And naturally I also have confidence in the scientific capabilities of the Advanced Genetic Sciences company, for as a member of its scientific board, I can follow its work very closely.

In summary, it is still too soon to tell which company will be the leader in this field, as plant molecular biology is still in its infancy. In any event, the work the R&D companies are doing in the medical field is far superior to what is being done with plants.

However, if we look at the economic aspect, it is the big chemical industry consortia which are in the best position. Before the first products can be marketed, they will have to be reviewed by control and safety commissions. A 5-year delay for a big company that continues to develop and produce good varieties is not too important. Dow Chemical, Du Pont, and Monsanto are all off to a good start in this field; they will be able to deal with the difficulties. One or two genetic engineering companies which are sufficiently well diversified may be able to survive, but the others are going to disappear.

Question: How many scientists work in plant molecular biology throughout the world?

Answer: Very few. If we count students, about 1,000 people. That is a ratio of 1 to 50 in relation to molecular biologists in general.

Question: What about in Japan?

Answer: The Japanese are waiting to see what we do here so they can apply it. Some pharmaceutical industries do have their cell cultures. The Japanese specialize mainly in microbiology. They have some very big experts in soil microbiology. They have a great deal of data on microorganisms that live in symbiosis with plants. This will help them to find interesting genes to integrate in plants. But they made no contribution to the "Agrobacterium" Ti plasmid, the vector used in plant genetic engineering. They all want to come here to be trained in our methods.

Question: Might there be a place in Europe for a plant genetic engineering complex?

Answer: I'm sure of it. Right now, the Plant Breeding Institute of Cambridge in Great Britain has some good scientists, but I don't think they have the right industrial structure. The Agricultural Genetic Company also has a good staff, but it's too soon to say whether they will succeed.

In Germany, Bayer, Hoechst, and BASF are making a major investment, and are setting up their own research institute in plant molecular biology. They have contracts with universities or research institutes: Bayer has invested about 5 to 6 million French francs with Professor Schell, in the Max Planck Institute in Cologne. Hoechst and BASF want to do the same sort of thing. Hoechst did have its much publicized agreement with Massachusetts General Hospital, which is also working in plant molecular biology.

Question: What is your impression of what is going on in France?

Answer: If Elf Aquitaine had wanted to, it could have done quite well in this field in its Toulouse center. But Sanofi felt that it would be better to stay in the medical field. They will surely come to realize that they were in a quite good position. They certainly have a good opportunity... I know that the Pasteur Institute in Lille wants to develop its capabilities in plant molecular biology. In Strasbourg, a unit is going to get started, in a place where there is a strong tradition of research on plant viruses; it may play an important role, when they see the contribution made by animal viruses to our knowledge of mammalian cellular biology. Until now, plant viruses have been used to study crystallography and virus structures. Very few of the right questions have been asked about plant cells. That could cause something new to happen. But I don't know if they have enough resources and the capacity to handle more people.

Rhone Poulenc might be able to do something in this area.

Transgene could add on a plant biotechnology wing if they find qualified people to staff it. And there we come back to the initial point I mentioned: in plant molecular biology there are really no scientists with the same knowledge and experience that people have in the medical field.

Question: The recent agreement between Rhone-Poulenc and Calgene for research on a variety of sunflower resistant to a herbicide, technically speaking, follows basic research. In your opinion, can this type of research succeed?

Answer: Conceptually, yes. It has been proven that genes can be transferred to plant cells by using "Agrobacterium," and we do know how to regenerate a great number of plants from cells or tissues. The big question

today is to decide what constructions to make of them. The ones done most often will be those in which, by adding one or two genes coding for enzymes modifying a product, we will be able to change certain properties of the plant. For a bacterium, this may be resistance to an antibiotic; in plants, it may be resistance to a herbicide or an active agent affecting a particular aspect of the plant's growth.

For each herbicide, we can find a microorganism in nature which will break it down. Once the enzyme has been obtained, it may sometimes be necessary to modify it by "protein-engineering" to make it more stable, but we can splice it in the plant.

This is a correct concept, and I would say that all the companies doing such work proceed along these lines.

But in this precise instance, I believe that the decision to work with Calgene was motivated by the fact that this company said it could regenerate the sunflower from protoplasts. Personally, I am not at all convinced that the regeneration obtained will be sufficient to use this method in genetic engineering systems based on the Ti plasmid. Moreover, it is important to understand that today the use of protoplasts is no longer essential in order to make a gene transfer. The Ti vectors which have been developed may very well be used directly on a differentiated tissue. I am afraid that the selection of a procedure may be a troublesome issue for the big chemical firms that want to add a plant genetic engineering capability. Among the staffs of the chemical industry, we only rarely find specialists sufficiently up-to-date on recent progress made in this field, which has advanced so rapidly in recent years.

Question: How is a gene transferred to a plant?

Answer: The "Agrobacterium tumefaciens" system: a gene is cloned, using the Ti plasmid; specific sequences are then attached to it, which will affect the organ where it is to be spliced; it is transferred to the plant cells, using Ti as a vector; and then the plant is regenerated. The procedure is always the same. It is something that can not be done in mammals or in man.

The regulating sequences may be taken from many plants, ahead of a protein that is spliced only in a particular tissue (leaves, seeds, etc.). A very good inventory of these genes has been prepared in Cologne for the potato. It is rather easy to obtain regulating sequences which are spliced in a series of plants: for example, Agrigenetics has proved that sequences regulating the kidney bean also function in tobacco. So we can splice a gene onto a specific organ of the plant (see NATURE, 12 July 1984). Of course, there will always be some exceptions and some minor technical problems, but conceptually, this is simple and quite feasible.

Question: What are the areas, in food production and in agriculture, that are going to be rapidly affected by biotechnology?

Answer: As I said earlier, there are all the operations that will transfer one or two genes to a plant to give it a new property.

In the small company that we set up in Ghent, Plant Genetics Systems, we are working to increase the nutritional value of kidney beans, which lack sulfur. Working with a Brazilian research institute, we isolated the gene from a reserve protein of the Brazil nut, which is very rich in sulfur; it contains 12 methionines and a series of cysteines. According to the FAO [UN Food and Agriculture Organization] criteria, it takes just a small quantity of this protein in kidney beans to give them the same nutritional value as a sulfur-rich grain. This project may be carried out within the next 18 months. In South America, this type of bean is a very widely used food. This is not a project that will have any great commercial appeal. But can a business get rich while hunger still exists in the world? That's another issue.

Another example is the case of "thaumatine," which has been cloned by Unilever. This protein, which is 50,000 times sweeter than sugar, can increase the flavor of whatever is being eaten. For this reason, it has to be used in small quantities as a "protein precursor." We spliced it in tobacco some time ago. It could be spliced in all sorts of fruits or vegetables, or in products that have good nutritional value, but which people don't eat because they are too bland. The United States is a good example of a country where tomatoes, strawberries and asparagus don't have the slightest taste. In Belgium, it is now being used as a curiosity on strawberries. For each plant variety, it would take from 6 months to a year. Right now, we don't yet know if the product will be stable in all plants. We asked Unilever if they would be interested in pursuing this work. I'm sure that their answer will be yes.

It will be possible to transfer to a plant an enzyme that no longer responds to a certain feedback and obtain an overproduction of some compounds. For example, the biosynthesis of lysine from aspartic acid in "E. coli" is regulated by an inhibition of the aspartic kinase, the first enzyme of the chain, by the final product. We know a mutation of this enzyme which is no longer sensitive to the retro-inhibition of lysine. The result is that the bacterium produces a good quantity of lysine. In this way, we could obtain grains richer in lysine. This is a principle that we will be able to apply for the production of other compounds as well.

To get back to herbicides, whenever someone finds "a candidate" (resistant bacterium, among microorganisms of the genus "Pseudomonas") in a field or in a warehouse where herbicides have been stored for a very long time, there will be a possibility of identifying and isolating a gene determining the breakdown of the herbicide. Then we will be able to transfer the gene to

plants. Depending on what sort of luck we have, this work may take from 2 to 4 years. We will then be able to introduce the isolated gene and see if it "takes." There are dozens of places where this is now being done. Rumor has it that Monsanto and Du Pont are almost at the point of getting some results. It wouldn't be surprising for people to begin to test plants within a year. For the time being, the results concern only the legumes and brassica [cabbage] family.

Question: This will mean that companies will sell seeds and the herbicide that goes with that seed variety.

Answer: Yes. Almost everyone working in this field works with seed companies. And the big seed companies themselves have set up some associations.

Question: Are there new research concepts for plant health products and herbicides in particular?

Answer: The concepts will always be the same: there is a product that is toxic for a series of plants, the "weeds," but there is also an inhibiting action on the crop. We would like the crop itself to become resistant. So far, we have used selective herbicides. But the companies also have available to them less selective and very spectacular herbicides. If they can find enzymes capable of breaking these herbicides down, they will then be able to construct a resistant plant.

Moreover, with the advances in molecular biology, mitochondria and chloroplasts are good targets for fairly simple proteins. By cloning these proteins, we may imagine, using "computer design," molecules that will bind themselves to these proteins. Thus, we will be able to "design" herbicides.

It would be very interesting to find products which, being highly specific to the plant's metabolism, would not be toxic for mammals.

Certainly we can also obtain resistances against viral infections, starting from the virus itself.

Question: What about resistance to bacteria?

Answer: A pathogenic bacterium secretes a toxic product that can be identified, and which is linked to the presence of one or two genes. Moreover, the bacterium, because it is pathogenic, necessarily has the property of colonizing. Consequently, if we eliminate pathogenic genes and if we add another property to the modified bacterium, a specific toxin against pathogenic bacteria, we will be able to coat seeds or sprouts with protective, non-toxic bacteria that can not be driven away by other bacteria.

Question: That's the same strategy used for "frost" [or "gel"] bacteria!

Answer: Yes. Advanced Genetic Sciences is doing this sort of work. I have followed discussions concerning "frost bacteria" very closely, given my ties with AGS.

Question: Do you think that there is room in Europe for this type of modified organisms?

Answer: I'm sure of it. [It would be useful] in every country where there is a danger of sudden freezes to which plants cannot adapt, particularly plants such as fruit trees. But to be even safer, we would have to redo the same procedure using local bacteria. That would only take 2 months at most. The difference between the United States and Europe is that they have very large areas planted in a single crop, either vegetables or fruits, which consequently represent a great economic value to their owners. In Europe the plantings are much more diversified.

Question: What sort of safety problems might arise? In the medical field, such problems are quite significant.

Answer: They are the same as for the use of isolated stocks in nature. This has been shown by all the recombinant DNA research done in medicine.

Plant Genetic Engineering Vectors

The "Agrobacterium" System

We owe all of the current successes of plant genetic engineering to this system. To start with, it is a symbiotic system: a plasmid carried by the Agrobacterium transfers part of its genome to the host plant, which produces and exports molecules which serve as a substratum for bacteria. Moreover, the initial transformation is amplified by the stimulation of cell multiplication. Today "Agrobacterium tumefaciens" ("Galle du Collet") and "Agrobacterium rhizogenes" ("Hairy Root") are used.

This system offers the following advantages:

a. The transferred DNA (T-DNA) is integrated in the DNA in a stable manner and it is transmitted through meiosis;

b. The Ti plasmid possesses sites where foreign genes can be inserted. A non-tumorigenous vector has been developed by Professor Schell's group. This vector contains only the ends of the T-DNA, with the pBR 322 plasmid;

c. All dicotyledons can be transformed by "A. tumefaciens." Recently two monocotyledons were transformed by the Ti plasmid (see this issue).

The "Caulimovirus"

The Cauliflower Mosaic Virus has been carefully studied. It offers the following advantages:

a. It is a small double-strand genome which can easily be handled "in vitro."

b. Viral DNA is infectious by rubbing on healthy leaves.

c. The virus spreads in the plant and a large number of copies can be found in most cells.

But this technique also has some disadvantages, such as:

a. It can only be transmitted to a small number of hosts: the "cruciferae" (cabbage, cauliflower, mustard), and some "solanaceae" [nightshade family] plants (tobacco, carrot).

b. The size of the transferable genes is quite limited.

c. It is not transmitted through sexual reproduction.

Other Vectors Studied

Among the other vectors studied, we should mention:

Bare DNA, whose results are quite controversial. Thus, the transformation of protoplasts by liposomes has been obtained, but no integration was observed. In a similar way, the microinjection of pollinic tubes in germination before fertilization is being attempted by Flavell, Peadock and Goodman. This would make it possible to eliminate the barriers of the host spectrum, and problems related to plant regeneration, a major problem of the "graminae."

"Transposons" (see BIOFUTUR, no 19, December 1983). Discovered by B. McClintock in corn, they seem to exist in other plants (tobacco, petunia) as well. The Ac and Ds genes of corn have been cloned and sequenced. An analysis of their potential utilization, comparable to that of the P elements in Drosophila (mutation by insertion, insertion of foreign genes) is just beginning.

PGS (Plant Genetic Systems)

Plant Genetic Systems (Ghent, Belgium), founded in March 1983, is a research and development company designed to disseminate the industrial applications of discoveries made by Professors Schell and Van Montagu in plant genetic engineering.

When founded, its capital was 56 million French francs, broken down as follows: 21 million from the Flemish General Investment Company; 14 million from Tirlemont Refineries; 14 million from the Swedish seed company, Hilleshog, SA, a member of the Cardo group; and 7 million from Radar, S.A. (food additives). It shares a common scientific board with the U.S. firm, Advanced Genetic Sciences, Inc., of Greenwich, Connecticut.

PGS has begun a protein-engineering program for the food processing industry, scheduled to last for 7 years, costing about 140 million French francs. A research staff from four European countries will take part in this program.

In Belgium

a. The research labs of PGS (Ghent) (Professors Van Montagu and Zabeau) for genetic engineering techniques, DNA and protein synthesis, "hidridomes" and enzymology techniques.

b. The molecular modelling lab at the University of Brussels, directed by Professor Prigogine (Nobel Prize).

c. The Nuclear Magnetic Resonance Unit of Professor J. Jeener and that of Professsor Van Binst at the Free University of Brussels.

d. The biological dynamics lab (K.U. Leuven) of Professor Engelsborghs for the study of the kinetic properties of macromolecules.

In the Federal Republic of Germany

The lab of Professor Jaenick (University of Regensburg) for the measurement of the thermodynamic parameters of protein solutions.

In Switzerland

The lab of Professor Wuthrich (Eidenosische Technische Hochschule) in Zurich, for the study of "structure-function" relations of macromolecules.

In France

a. The physico-chemical biology lab of Professor Janin at the University of Paris-South, Orsay Center, for the study of large-size proteins by radiocrystallography.

b. The enzymatic technology lab at the CNRS [National Center for Scientific Research], Professor Thomas's lab at Compiegne, associated with the INSERM [National Institute of Health and Medical Research], for some aspects of applied enzymology and prototype studies.

c. The biochemistry lab of Professor Blanquet at the Polytechnical School at Palaiseau, for specific problems of enzymology.

7679
CSO: 3698/163

CIVIL AVIATION

DISCUSSION OF AIRBUS PRODUCTION, SALES, LINE EXPANSION

Paris LE FIGARO in French 24 Dec 84 p 11

[Article by Pierre Kerlouegan]

[Text] The year that is about to end has not been bad for the European aircraft manufacturer, whose production rate will nevertheless slow next year. To meet the projected demand for 1986, however, production will have to be resumed.

Is this to be the long-awaited rebound in aeronautical construction? It would be premature to affirm that it is, but there is no getting around the fact that the order books of the world's two leading civil aircraft builders have bulged this year.

Boeing has chalked up 169 orders versus 151 last year, while the European consortium which builds the Airbus has, for its part, captured 65 orders versus 24 in 1983. This total does not include the three Airbuses that China seems intent on buying, or the 10 or so others that three airline companies--anonymous for the moment--are on the verge of buying.

The year that is about to end will thus be the best since 1979 for the consortium. "1979 saw the launching of the A-310 and, all versions taken together, we got 128 orders," says Bernard Lathiere, CEO [chief executive officer] of the consortium. "This year, we have launched the 150-passenger Airbus A 320, and the result has been the one you are aware of, although the air transport industry has still not fully recovered its vitality."

The Pan Am Year

But 1984 will go down as the Pan Am year: 24 orders, 47 options and 16 leased planes that will be entering service within the next few days (see boxed insert [at end of this article]). Moreover, the consortium is not walking away from the American market. It is currently engaged in talks with several companies, particularly Federal Express, which, after having preferred McDonnell Douglas one year ago, may also acquire some Airbuses, either new A 300-600's or used planes.

However, the consortium's most sizable current negotiation on the other side of the Atlantic is the one it is conducting with Delta Airlines, a domestic airline in search of a 150-passenger plane to replace some 100 DC-9's and B 727-200's.

With or without Delta Airlines, the consortium's workload is on the rebound. And even though 1984 orders are not expected to have an immediate impact on its assembly lines, it would appear advisable to up the consortium's production rate.

This rate will be dropping from its present 4 planes per month to 3 per month in 1985. In a recent study, an American bank, the First Boston Corporation, estimated that the Europeans should raise their production rate rather than lower it. "That is also my view," says Bernard Lathiere. "Otherwise we risk running short of planes beginning in 1986."

Enlarging the Family

The executive committee of the consortium, consisting of its industrialists, will be taking up the question in January, but it appears to be leaning heavily towards caution, remembering that, at this time last year, the consortium had on hand all of 20 or more unsold planes: Their buyers, short of cash, had been unable to take delivery of them. "We have placed more than half of them this year," Bernard Lathiere points out, "and the 10 or so that remain will find takers within the next 6 months."

There remains the question of enlarging the Airbus family--an ever-present one which, for the moment however, does not require an immediate answer. Nevertheless, the design departments are working on the TA-11 version, a 4-engined, 220-280-passenger, long-range jetliner, in which Lufthansa as well as the Scandinavian S.A.S. airlines have shown interest.

This plane will be equipped with the engine and cockpit of the A-320, the fuselage of the A 310, and a wing very close to the one contemplated for the future TA-9, a 330-passenger medium-range liner. "For all these reasons, the development cost of the TA-11 will be low," explains Bernard Lathiere, who does not foresee its actual launching "for another 2 or 3 years yet, aimed at its entry in service by 1991 or 1992."

[Boxed insert]:

Pan Am: Under Way

The first stage of Airbus's program of deliveries to the American airline Pan Am has been completed with the delivery of the first four A 300-B4's, which entered service immediately.

According to Pierre Pailleret, the European consortium's marketing manager, these planes have been fully paid for--$160 million--by an American firm that is leasing them to Pan Am. Eight other A 300-B4's and four A 310-200's will be delivered to Pan Am before the end of the first half of 1985, for a total of $680 million.

Mr Pailleret, who states that the negotiations were carried out within the spirit of the letter of intent signed last 11 September by the American company, estimates that the second phase of the contract, concerned with the long term, could be completed within the first few months of next year. "This would involve an order for 12 wide-bodied A 3-300's [as published] (a twinengined jetliner capable of transporting 210 to 280 passengers) and 16 A 320-200's (a 150-passenger plane featuring an entirely new technology), for a total of around $1 billion," he said.

After recalling that the American company has taken purchase options, furthermore, on 13 A 310-300's and 34 A 320's, the marketing manager stated that the contract would provide for "a flexibility enabling Pan Am to change the types of planes involved--for example, substituting for an Airbus the future 4-engined long-range plane, the TA-11, currently under study."

9238
CSO: 3698/189

CIVIL AVIATION

MBB SPOKESMAN ON INCREASING AIRBUS MARKET SHARE

Bonn DIE WELT in German 9 Nov 84 p 13

[Article by Peter Jentsch:"Airbus Industrie and MBB Want to Increase Market Share"]

[Text] According to a presentation by the director of MBB's Transport and Passenger Aircraft Division, Johann Schaeffler, Airbus Industrie has captured a 30 percent share of the large aircraft market. Of the total passenger aircraft market, this corresponds to a 15-percent share.

In a presentation dealing with "goals and opportunities of large aircraft construction in Germany," Schaeffler emphasized, it is the objective of Messerschmitt-Boelkow-Blohm and Airbus Industrie to further establish themselves as strong offerers of large aircraft. Airbus Industrie's market share has to be expanded to such an extent,"that the European industry can survive all-out competition from the US manufacturers." This corresponds to a 30-percent share of the world market. To express that in number of airplanes: today there are about 5,000 large airplanes in service worldwide; up to the year [year not stated, probably 2000] this number will increase by 3,700 to about 8,700 airplanes.

In order to achieve this objective, Schaeffler believes that a concerted effort has to be made to bring in those European countries not yet sharing the Airbus risk, primarily Holland and Italy, for the purpose of making penetration into the European market more difficult.

Schaeffler underscored the long-term intention of making large aircraft construction independent of government subsidies. At the same time is it the goal of MBB to make large aircraft construction an important constituent of the company's economic power.

9160
CSO: 3698/119

CIVIL AVIATION

FRG SAYS DEUTSCHE AIRBUS SHOULD LOWER PRODUCTION COSTS

Duesseldorf WIRTSCHAFTSWOCHE in German 2 Nov 84 pp 23-25

[Article:"Airbus Production Cost too High]

[Text] In a previously unpublished special report on the Airbus project, the Government Accounting Office asserts that a more effective cost control process by the Federal Government is a necessity. Also, greater investment on the part of industry is desirable.

The Treuarbeit AG auditors came upon something remarkable at the aerospace firm Messerschmitt-Boelkow-Blohm (MBB), the manufacturer of fuselage and wing sections of the European Airbus: MBB regularly billed the German Airbus contracting agency, Deutschen Airbus GmbH (DA), for corporation profit taxes even though this tax did not apply. In addition, for two years MBB also billed for excessive interest charges running into the millions. This liberalism can have consequences for the aircraft builder: In a special report--previously unpublished--concerning Airbus financing, the Federal Accounting Office advised the Bonn Government "not to completely" dispense with "external controls."

Although the primary financer and sole economic risk bearer of the Airbus program, the Federal Government is presently completely in the dark concerning actual costs for serial production. Thus, the accounting office auditors deplore in their 16-page audit report, "that neither the contracting agency, DA, nor the government is in a position to verify the propriety of the serial production costs claimed by the industry, MBB.

The program costs to the government run into the billions. In accordance with planning for the A-300 and A-310 Airbuses, the government is obligated to participate with subsidies of not only DM 7.4 billion for the development cost and sales financing but also to underwrite the credit-financed production costs up to DM 4.1 billion (BUSINESS WEEK 38/1983). And if sales proceed are not sufficient through the end of the program in 1994 to amortize the production credit, the government must again become involved as guarantor.

Without directly stating the suspicion, the report implies throughout that the cost effectiveness of MBB's production can be improved, resulting in a lower guarantor risk to the government. Accordingly, accounting office officials cite an earlier critique to the government that the industry "still does not have the

proper level of cost awareness." The auditors recognized a basic problem: "A dedication to cost reduction did not exist in the companies involved since in the case of public contracts in the military area on which these companies largely existed in the past, the government pays actual costs plus a profit which increases cost.

Suspicion that Airbus production cost is too high had cropped up earlier. In 1980 the consulting firm McKinsey under government contract had located an additional potential savings of DM 630 million relating to Airbus production; it later turned out that the saving "was actually not realizeable" (accounting office audit report). In a countermove the industry had invoked a claim for cost overruns compared to the plan amounting to DM 762 million. Clarification attempts by the government "could not, however, determine," confirmed the accounting office retrospectively, whether the cost overruns "would actually occur or if they were only based on extremely conservative assumptions of industry and are thus 'retained'."

The accounting office is skeptical that the measures put in place by the government in the meantime to induce MBB to lower its costs will actually yield results.

Under these measures, the government is adopting a new remuneration system--instead of the previous cost refunding with an upper limit, in the future a top price with cost reduction incentives will be awarded as the contract value. Then, if MBB comes in under its contracted cost estimate, the manufacturer can book a large part of the difference as profit

It is also "questionable," in the view of the Government Accounting Office comptrollers, whether--as intended by the government--effective control can be achieved through Deutsche Airbus GmbH which is a wholly owned subsidiary of MBB. For this purpose, Bonn delegated in 1983 two government officials--Manfred Schueler of the board of the Reconstruction Credit Establishment and Werner Lamby as board member of the government corporation Viag--to the DA board of directors. They were to concern themselves primarily with the improvement of program controls, the maintenance of program planning and monitoring the effect of the new remuneration system. However, that the government's interests can be more closely guarded by this measure than was the case previously is doubted by the Government Accounting Office because "to date, only two board meetings of short duration have been held each year."

But no new ideas--outside of "external control"--occurred even to the accounting office controllers. Thus, the Government Accounting Office proposed that Economics Minister Martin Bangemann try again to get "a stepwise increase in industry's financial participation" in the Airbus program.

But that is what Bangemann's predecesssor Otto Graf Lambsdorff had tried in vain to do for a long time. As before, the Federal Government still pays 90 percent of the costs for basic development and 85 percent of the costs for product improvement, and as before it underwrites the production credit with a 100 percent guarantee.

Lambsdorff succeeded only in increasing the industrial payback guarantee from the original 10 percent to 25 percent. But even this increase, which moreover was limited by an insolvency protection clause in favor of the repayment guarantor came

at a high price to the government. In the countermove, the government dispensed with the installment payback of development cost subsides to the end of the program in 1994--"an interest load for the government running into the billions," according to accounting office figures. And if Deutsche Airbus GmbH earns no profit after 1994, the government will finally dispense with the payback of DM 2.2 billion. The Government Accounting Office fears in the meantime a new edition of the one-sided load and risk distribution with the production of the planned new A-320 Airbus. The Frankfurt auditors are remembering the Bonn government in earlier cabinet resolutions according to which additional projects could only be considered," when the industry demonstrates that it can produce at a profit and that it requires no government funds for production."

But even the accounting office leaves a way out: The Federal Government should attempt to enforce these concepts on the A-320--"at least in principle."

9160
3698/119

CIVIL AVIATION

BRIEFS

AIRBUS FATIGUE TESTS--In the past few weeks, the Airbus A 310 has successfully undergone mary fatigue, aging and fracture tests. Thus, at the Toulouse Aeronautical Testing Center (CEAT), the aircraft structure withstood a load equal to 1.67 times the load the aircraft might have to bear under the worst possible operating conditions. On the verge of breaking, its wings then assumed an impressive curvature. According to Airbus Industrie, this result shows the high quality level of the engineering departments which designed the A 310: usually, an aircraft is not expected to have a safety factor in excess of 1.5. At the same time, an Airbus A.310 structure withstood 90,000 fatigue cycles (one cycle simulates a complete flight, including takeoff, flying proper and landing), whereas the aircraft, which has an expected life time of 20 years, should not have to go through more than 40,000 cycles. [Text] [Paris L'USINE NOUVELLE in French 22 Nov 84 p 15] 9294

CSO: 3698/204

COMPUTERS

'ESOP' EXPERT SYSTEM MODEL DESCRIBED

Paris MINIS ET MICROS in French 8 Oct 84 pp 91-94

/Article by Pierre Jouvelot and Daniel Le Conte des Floris: "Artificial Intelligence and Introduction to Expert Systems: The Esop Mockup as an Example"/

> /Excerpts/ Instead of making long speeches on the general structure of what an expert system (SE) is (or could be) from the viewpoint of implantation, we have here gone the route of presenting a design of this type of program. We are talking in this case about a mockup called Esop (Expert System Open Propositional) implanted by the authors in Pascal language on a microcomputer /NE 79/. The goal to be reached was to test the validity of the concept of meta-rules within the framework of the logic of the propositions.*

The system described here as an example has the following characteristics:

--Use of a number (any number) of levels of knowledge;
--Notion of the level of visibility of facts (the notion in which a known fact at level i is not accessible to the rule basis of a lower level).

It must be said, nevertheless, that for an application of "actual size in nature" we should perhaps have had trouble getting beyond two levels (knowledge and meta-knowledge). We also let it be known that other interesting particularities had been considered:

--Procedural attachment (that is, the possibility of releasing actions at the moment an operation is activated;
--"Open" inference motor in which new strategies for manipulating the rule bases are easily implanted.

In the Esop system an operation is of the form:

vertebra, scale, oviparous, gill $\longrightarrow$ fish (A)

which indicates that if the facts "vertebra," "scale," "oviparous," and "gill" are vertified, then one can deduce that one is dealing with a "fish." The

*See also MINIS ET MICROS, No 216, in which the fundamental principles of expert systems were set forth.

characteristic A (for displayable) indicates that such a conclusion must be given on the screen to the user (the fact is considered pertinent and is not merely an intermediate result). Another example:

incisor (0.5) # thick-skin, # fin

which indicates that if the animal under consideration has incisors, then it has neither "fin" nor "thick-skin," with a validity of 0.5.

We shall have an opportunity to come back at greater length to this idea of validity of, or confidence in, rules in an article in the near future. Let us simply say for now that this is a question of a sort of probability which measures the degree of confidence in the conclusions.

The Esop system is made up essentially of two parts:

--A compiler: With an Ascii card index which contains the bases of rules, it makes sure that their syntax is right and it generates a certain number of tables which allow their efficient use. These are not modified by the inference motor; they are therefore called "static" and are evaluated only once.

--An inference motor: It begins by initiating a certain number of work tables called "dynamic" work tables. Effective use of the SE can then start after the user has, if he wishes, introduced a basis of known facts.

To gain a good understanding of the way the motor is built, it is most important to know the structures of the data used: their handling, once the principle of this type of SE is well understood, is comparatively easy, at least if one limits oneself to a relatively classical motor architecture of the concantenated forward type. Two static tables are then found. One, the TSMOT, describes the environments in which the propositions (the words) are used, while the TSREGLE devotes itself to characterizing each of the rules of the basis. The static word table contains structures with the following components.

--An index INDID in a table of symbols identifying the chain of characters corresponding to the current word;
--A PRGCONC checker on a concatenated list containing the numbers of the rules of which the word is the conclusion;
--A PRGPREM checker for those where it is a premise;
--A PCARACT list of the characteristics proper to the word (displayable, accessible or other).

As for the static table of rules, each of its elements is a structure putting together the items of infomration below:

--A real VAL corresponding to the weighting coefficient of the rule;
--Two PNOPREM and PNOCONC checkers for lists containing the numbers of the facts (indices in TSMOT), premises and conclusions (the numbers are negative if the negation of a fact is used);
--An NBPREM integrator indicating the number of premises (is calculated once for all for reasons of efficiency);
--A PNOACT checker for the list of addresses of actions to be activated when the rule is activated.

These tables, once determined, are written on disks because they can be reused as they are during subsequent execution of the SE (Fig 1). On the contrary, the dyanmic tables will have to be reinitiated each time they are called up. One distinguishes among two--TDMOT for propositions and TDREGLE for rules. The dynamic table of words puts together for each fact the variables:

--VAL, current value of a word;
--ETAT, indicating whether additional items of information on the fact have previously been asked from the user;
--NIVEAU, which allows one to know on which rule basis it is known. Similarly, for the dynamic table of rules one finds the following items of information:
--ETAT, indicating whether the rule has previously been used, whether it must be pulled (all its premises have been verified) or whether it is blocked (since the values known at a given moment are not sufficiently convicing to conclude on a possible draw);
--The number NPRES of premises remaining to be verified in the rule, as well as the number NPNDR of remaining premises not subject to being asked for (these are the data used in various heurisms of the motor).

We shall not specify the way in which these structures of data will be handled in a "classic" motor using forward concatenation. It seems to us in fact to be of more interest to call to mind the way in which the Esop motor, which has a certain number of original characteristics, works.

The fundamental principle of Esop is to suppose that knowledge is characterized by a hierarchy of concepts. In order to implant this idea, we have seen that one could use in Esop any number of rule bases which correspond to these different conceptual degrees. Communications between these different levels are carried out with the help of a single structure of data: the file.

The level layer i gives to the lower layer i - 1 a set of commanders stored in a file which is the parameter of a recursive procedure INFERE. These commands correspond to the numbers of rules which the lower level must try to pull: they are determined at the level i by actions tied to rules, and this is carried out taking into consideration facts present in the knowledge basis. A classic case is the function VIEW: in the example

$$A, B \longrightarrow C : \text{VIEW}$$

one will generate, if A and B are true, the list of rules of lower level which have C in the list of their premises. A disk system allows introduction in a very smooth manner (Esop is an "open" system) of all strategies that can be envisaged.

Let us recall, in this connection, that a fact is only known at a given level j if the component NIVEAU of the structure which characterized it in table TDMOT is less than or equal to j. This is a natural enough idea: the facts are known by all levels, while the meta-facts (which can be but conjectures) are not accessible to the lower levels closer to reality.

Let us see concretely how all this works. At the highest level one systematically sweeps all the meta-rules. The first one whose premises are all verified (NPRES is equal to zero) is then activated. The conclusions are evaluated at the level

concerned, while the action possible determines (in a procedural manner) the list of lower-level rules which it will be necessary to try to pull. One then connects up recursively with the lower-level inferecnes: as the case may be, the process takes up again for the first rule of the file which has been generated. As soon as all rules thus extracted have been pulled, one can deactivate the mother rule of higher level. If nothing more evolves in the basis one then tries to do an exhaustive search at the lower level. If this remains without effect, one then questions the user, and then the control is given back to the highest level.

Note on the PDISs /Pattern Directed Inference Systems/

The SEs, most often easily assimilated to software based on a production system, are in fact only one particular type of PDIS or pattern-directed inference system. Although we do not want to take up the study of PDISs in all their aspects, we nevertheless feel it is necessary to note that the method previously proposed is not the only one which produced artificial intelligence emancipated from the rigidity of lcassical programming.

By way of concluding this article, we will give a classification inspired by /HA 78/ of the different types of PDISs found in the literature (Fig 2). The areas of application of these various architectures are largely beyond the scope of "engineering" of knowledge (to which the SEs belong) and allow tackling problems as varied as learning, program synthesis, speech comprehension, etc. To complete and illustrate the generalities given here, we shall propose in an article in the near future a complete little SE written in Lisp. We shall then be in a position to tackle subsequently a study of some of the most significant expert system designs.

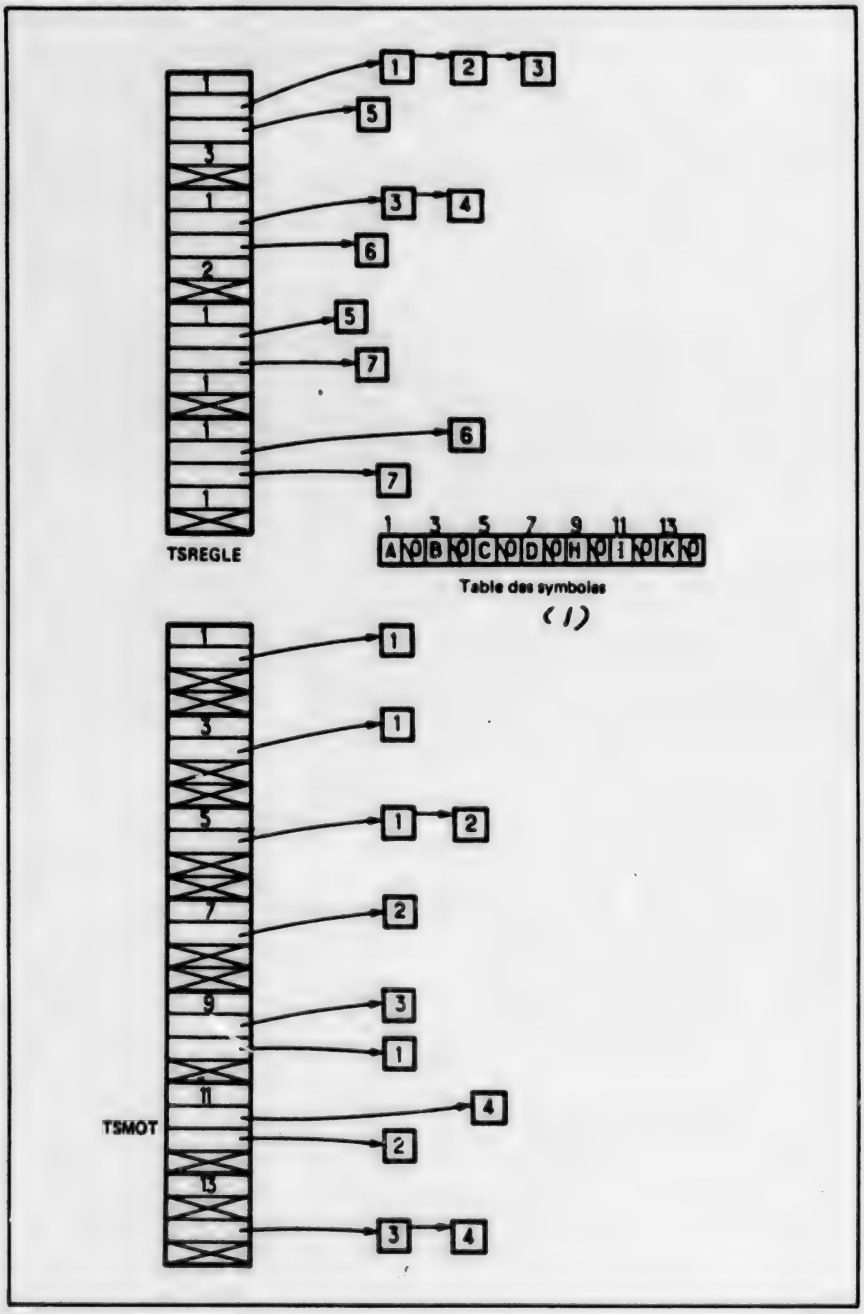


Fig 1. Value of the Tables TSMOT and TSREGLE and the Table of Symbols for the First Rules of the Boxed Material Opposite*

Key:

1. Table of Symbols

*/Not included in this translation/

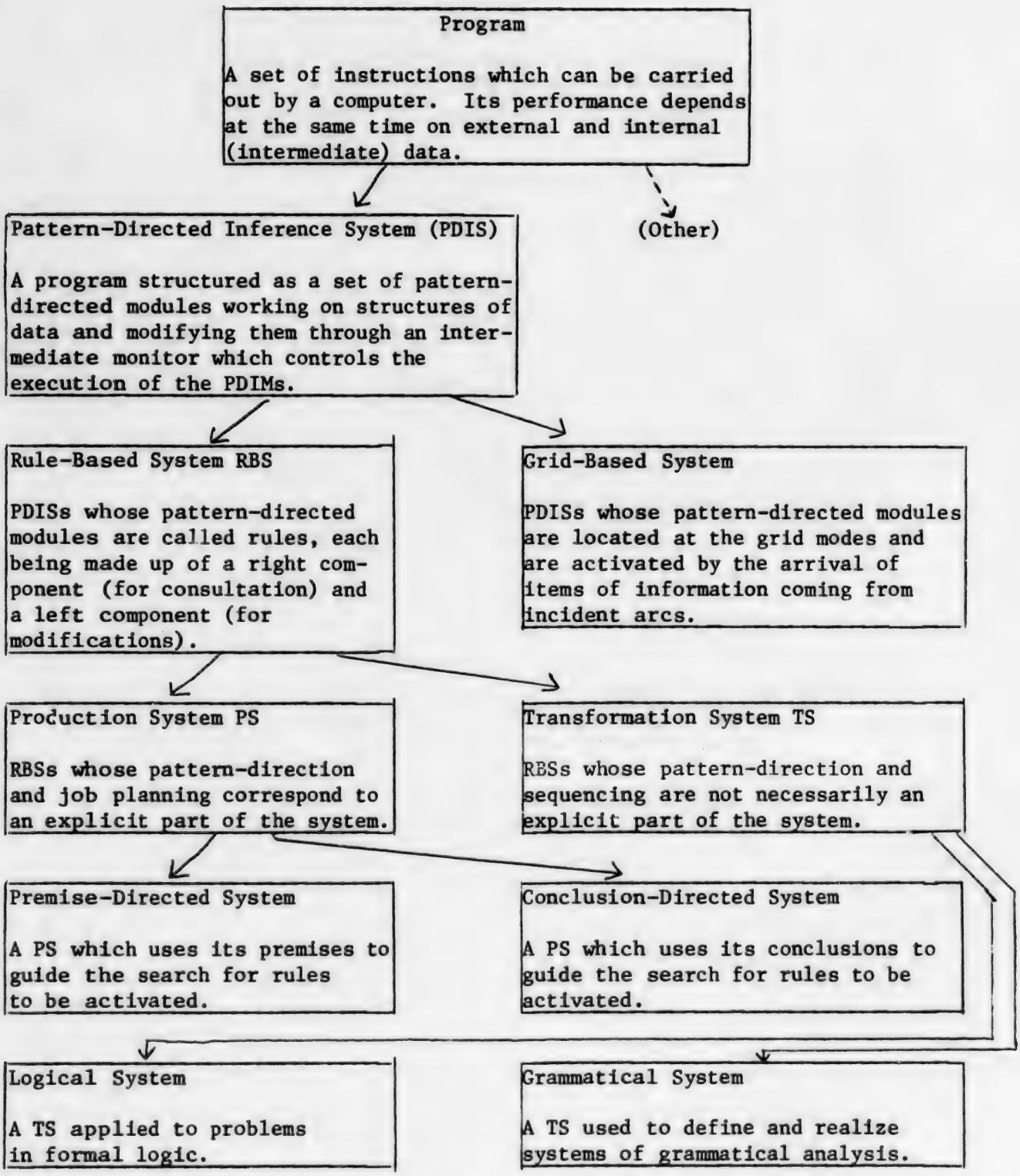


Fig 2. Classification of Different Types of PDISs

BIBLIOGRAPHY

1. /PIN 81/ Pinson, Suzanne, "Representation of Knowledge in Expert Systems," RAIRO INFORMATIQUE, Vol 15, No 4, 1981.

2. /DM 79/ "Expert Systems in Micro Electronic Age," edited by Donald Mitchie, Edinburgh University Press.

3. /BON 81/ Bonnet, Alain, "Application de l'intelligence artificelle: les systemes-experts" /Applications of Artificial Intelligence: Expert Systems/.

4. /NE 79/ Nevell, "Hierarchical Conceptual Modelling," Sigart Newsletter 3, 1979.

5. /HA 78/ Hayes-Roth, F., Waterman, D. A., and Lenat, D. B., "Principles of Pattern-Directed Inference Systems" Pattern-Directed Inference system /as printed/, Academic Press, Inc.

5586
CSO: 3698/141

COMPUTERS

BULL SEEKS CONTINUITY AFTER RESTRUCTURING

Paris INTER ELECTRONIQUE in French 1 Oct 84 p 7

/Article by Lucien de Salagnac/

> /Text/ A new work station, reorganization of two series of minicomputers: there are few changes in the Bull catalogue. Rather, the major concerns of the group are to assimilate its various componens following the reorganization it had to undergo when it became a nationalized firm responsible for French computer science, and to better use its potential in particular its human potential.

Novelty No 1: the Questar 400 data processing or office automation work station with its feeder-concentrator. This station includes a 16 bit and 256 Ko (extensible to 1 Mo) microprocessor processing unit, a 30 or 38 cm black and white visual screen or a 38 cm color screen, and a separate keyboard consisting of 105 keys, in 13 national versions. One can attach to it 630 Ko diskette units, 10 or 40 Mo disk units, and stylus or daisy wheel printers. The feeder-concentrator allows forming clusters of eight "co-active" stations. In the software area, Questar 400 is equipped with the Starsys multitask, multicontrol station system, which allows in particular the use of MD-DOS and of Prologue software. Moreover, connected to central systems, the feeder-concentrators can support up to 16 Questar 7107 or 7211 synchronized terminals with a rapid local connection. The central computer can be a DPS 4, a DPS 6, a DPS 7, a DPS 8 or a DPS 88.

The New Minis

The DPS 6 series is actually the former Mini 6, with which the new models are compatible in the area of software and peripherals. Six models make up the family from now on: the DPS 6/100, 210, 400, 450, 750 and 950. Equipped with a 512 Ko to 16 Mo memory, they use the GCOS 6 Mod 400 system of operation. To be delivered starting with the first quarter of 1985, these machines will be manufactured by Bull Systems at Joue les Tours.

As for the DPS 7, Bull offers from now on 10 models with the GCOS 7 system of operation. At the bottom of the series are the "07" monoprocessors (7/107S, 307, 407 and 507), and then the intermediate "17" multiprocessor systems

(7/617, 717, 817) and the "27," which are multiprocessor systems augmented by automatic reconfiguration devices (7/627, 727 and 827). The memories range from 2 to 8 Mo for the 07, from 2 to 10 Mo for the 17 and from 4 to 16 for the 27. The first deliveries are planned for the first half of 1985.

Training of Managerial Staff

At the same time as development of new products, Bull has set about improving their quality--both in the area of manufacturing (where a 35 percent improvement in the quality of finished products was announced, but without giving the method of calculation) and in that which concerns the knowledge of the various persons who make up the group. In 1984 all of the top 200 of the firm's personnel attended a 1-week seminar, and 3,000 persons, including 2,000 managerial staff members, underwent training. Next year it is planned to give this advantage to 17,000.

The Tree Is Judged by its Fruit

On the financial plane things are going better. After having suffered losses equal to 16.6 percent of its turnover in 1982 and 5.5 percent in 1983, Jacques Stern announces that this rate is expected to be less than 4 percent this year, despite the Trilogy failure for which a reserve of Fr 40 million has been set up, Bull's investment in this deal coming to 87 million. A balance may be reached starting in 1985. Perhaps thanks to the result of the investments made: research and development, productive investments and training are expected to be some 22 percent of the turnover this year, with Fr 900 million alone for industrial and commercial investments (50 percent more than in 1983).

/Box/

The Names of Bull

In reorganizing, Bull has decided to harmonize the designations of its computers. The big systems designed in collaboration with Honeywell (or NEC) are designated as DPS, plus 3 or 4 digits. Those which are particular to Bull (Sems) are the Scientific and Process Systems: SPS, with 3 or 4 digits.

Terminals intended for data processing and office automation will from now on be called Questar, also with 3 or 3 digits.

As for the microcomputers, they will all be called Micral followed by 2 to 4 digits.

5586
CSO: 3698/141

FACTORY AUTOMATION

TRUMPF OF FRG EXPANDS PRODUCTION BASE BY AUTOMATING

Paris L'USINE NOUVELLE in French 3 Jan 85 pp 16-17

[Article by Antoine Schoen: "Machine-Tools: Trumpf's Irresistible Rise"]

[Text] After the United States, Japan, Brazil and Switzerland, the German manufacturer is now extending its production structure to France. This confirms the dynamism of this company, which holds 75 percent of the German market and half of the French and British markets.

It is at Haguenau, in the Bas-Rhin department, that the German machine-tool manufacturer Trumpf, which specializes in sheetmetal working and cutting, has decided to establish its sixth foreign plant. This unit, which, starting next October, will manufacture all Trumpf machine frames and some sheetmetal box-frames, will make a modest start with 30 people or so.

All the same, the establishment in France of one of the most prosperous German machine-tool manufacturers is not without significance. This company was already represented in France through its sales subsidiary in Gonesse (50 people, FF 100 million in sales). The 80 people it will soon employ will contribute an added value of FF 50 million. At the German manufacturer's headquarters, this establishment was thought indispensable to compete on equal terms--as far as public aids to investment are concerned--with Promecam which manufactures in France under a Strippit license.

Trumpf, which was industrially represented in the United States already in 1969, has still expanded its production structure to Japan, Brazil and Switzerland. The evolution of the group's sales show the same dynamism: since 1974, they increased at an annual rate of 15 percent, reaching DM 290 million in 1984, 60 percent of which came from export sales. These results place Trumpf in the forefront of the European sheetmetal-working machines. Indeed, it holds 75 percent of the German market and half of the British and French markets. Its 10 percent shares in the U.S. and Japanese markets may seem modest. Yet, it is larger than the share of the German market which the Japanese Amada, Trumpf's main competitor, managed to conquer.

These commercial successes, which were just confirmed by a manufacturing license agreement signed with China, are due to the fact that the company is

headed by a brilliant engineer who was elected "Manager of the Year" for 1983: Berthold Leiblinger. The chairman of the Trumpf board, who owns 55 percent of the company stock (the remainder being held by the financier Hugo Schwartz), has based the growth of his company on the automation of manufacturing. Contrary to many machine-tool manufacturers who, during the 1970's, increased their personnel in order to expand their production, Trumpf decided to bet on automation. Already in 1982, its Ditzingen plant was equipped with a flexible workshop. With convincing results: the productivity of the company has doubled since 1978, and the 1,100 employees of the German plant have each generated sales of DM 200,000 this year. This is appreciably more than the DM 123,000 obtained on the average by other German machine-tool manufacturers.

Yet, it is not on this front that the Trumpf company is fighting its main battle, but against Japanese competitors, with considerable investments. "We shall have to continue our automation," Berthold Leiblinger confirmed. "The solution will be to integrate our flexible cells further into the production line." The present cells, designed to operate in three eight-hour shifts with a "ghost" night-shift (good-operation monitoring) will be connected to a central computer that will manage production.

Trumpf has decided to market the compter-integrated manufacturing knowhow acquired in its workshops. Trumpf System Technik, its engineering subsidiary specialized in automated sheetmetal machining, already has serious references obtained at Daimler-Benz, Calor, Emag, Onan...

But Trumpf's investments in computer-integrated manufacturing are also profitable more directly, through the sale of machine-tools. The Trumpf product line, of a very homogeneous design, is integrating advanced cutting methods (plasma torches and lasers) that were experimented successfully in the Ditzingen workshop. Next to these high-end products, Trumpf is also relying on another very promising product: the Trumatic 235. This punching-nibbling machine equipped with a numerical control with interactive-mode entry and very easy to use has enabled it to penetrate the market of small sheet-work plants which, until now, had been reluctant to convert to numerical control.

9294
CSO: 3698/205

MICROELECTRONICS

FRANCE'S IC STRATEGY TAKES SHAPE WITH THOMSON, CNET ACCORD

Paris L'USINE NOUVELLE in French 3 Jan 85 p 19

[Article by Claude Amalric: "Thomson and MHS Supported By Public Research"]

> [Text] It was quite in line with the logic of the sector that LETI [Electronics and Data-Processing Technology Laboratory] and CNET [National Center for Telecommunications Studies] should help Thomson and MHS [Matra-Harris Semiconductors] in their research. But the resulting incompatibility of technologies is a different matter...

The agreements signed by Thomson and the electronics laboratory of the Atomic Energy Commission (LETI) and between Matra-Harris and the Norbert-Segard Center (CNS) of the CNET are an important milestone in the creation of a French integrated-circuit industry, in spite of the inconsistencies that still persist.

Thomson is gaining advanced research on micronic CMOS [complementary metal-oxide semiconductor] integrated circuits (1.2 microns for the finest details), which should yield its first products already by the end of 1985. A submicronic process will be studied and should be ready around 1990, when the market will need it. A total of 180 people (130 from LETI and 50 from Thomson) will be sent to the brand new LETI labs in Grenoble. They will ensure the profitability of this considerable investment (FF 100 million, plus as much for the equipment...) and will relieve Thomson of all research worries, although it will still finance part of that research. That will give it the right to examine the orientations of LETI as far as components are concerned. According to a LETI cadre, who has worked under all the previous plans: "The distribution of industrial objectives has never been so clear." Actually, this agreement constitutes a localized merger of Thomson and LETI rather than a mere collaboration. It is quite natural since Thomson and the CEA have the same majority shareholder, the State.

Matra-Harris and the CNET did not go as far. The apparent similarity of the two cases is limited to their goals: a 1.2-micron CMOS process to be transferred by CNS to MHS in 1988. This process, which the CNS would have developed anyhow for the CNET's own needs is called a "telecommunications" process. It involves mixing analog elements and digital circuits on a single chip. It is a good deal for MHS, which is eying the communications market and, late

in 1983, had declined to work with LETI, as the latter's CMOS would have duplicated the one received from Harris.

As for the CNS, which receives all its financing from the state (whereas LETI must first give proof of an industrial partner's commitment before receiving a 50 percent subsidy for the project concerned), it had to keep its distances with a partner 50 percent of whose stock is in private--and U.S.--hands...

Under these conditions, the result was to be feared: the two processes, which after all are comparable, will not be compatible! We may wonder why the State, which finances both, did not demand compatibility. The result is that the indispensable reciprocal second-source agreement between the two French manufacturers is thus made very difficult, even impossible. "A test of strength between administrations," one negotiator of these two agreements hinted. A costly episode for, in the long run, compatibility appears ineluctable. We will have to pay again to get it later on.

9294
CSO: 3698/204

MICROELECTRONICS

CAD/CAM SYSTEMS FOR PRINTED CIRCUIT DESIGN, MANUFACTURE

Paris ELECTRONIQUE INDUSTRIELLE in French 15 Oct 84 pp 43-45

[Article by Catherine Gross]

[Text] In the very near future, all phases from the design to the fabrication of printed circuits, from the laboratory to the design department, will be automated, by means of end-to-end CAD/CAM [Computer-Aided-Design/Computer-Aided-Manufacturing] systems. These systems of the future will enable the rational transfer of data between software packages and work stations, from simulation to placement and routing, from physical layout to photo-plotter controls and automatic test benches. This plan is in the course of preparation by most suppliers, such as Racal Redac, SECMAI [Company for Study, Design and Construction of Industrial Machines and Equipment], and GE-Calma, who are already offering different pieces of the puzzle for use with VAX and Apollo minicomputers and even IBM-PC's.

Racal Redac's CIEE [Computer-Integrated Electronic Engineering] concept covers all electronics applications, from printed circuits to customized circuits. Available as of now are a schematics-acquisition station for the IBM-PC, as well as schematics-acquisition and simulation functions for the Apollo 32-bit station. Placement and routing software packages will be available for printed circuits in June 1985, and for microelectronics 6 months later.

Schematics acquisition on the IBM-PC includes a schematics software (Redlog), a comfortable human-machine interface with hierarchized menus, window, mouse, and the ability to transfer files to a central VAX or Apollo computer; the cost is 170,000 francs.

As regards simulation, Racal Redac has signed an agreement for use of HHB-Softron's Cadat software. Very much oriented towards printed circuits, Cadat offers, in particular, fault-simulation capabilities.

Racal Redac has also signed agreements with RDB [expansion unknown], for the use of a relational data base, and Apollo Computer, for the delivery of some $10 million of graphics stations over the next 18 months. Within the Racal Electronics group, interactive work is under way towards the coupling of

simulation and automatic testing: Software interfaces will enable CAE [Computer-Aided-Engineering] stations to compare data obtained from logic analyzers, such as the Racal Dana 200 Series oriented towards tests during production, with theoretical-simulation data. This will close the loop between design and fabrication.

Meanwhile, the VAX line of PC 600 systems, 17 of which are installed in France (80 worldwide), have been equipped with a new automatic router. Racal Redac asserts it has come up with an upgrade-compatibility system, so that a printed circuit card, processed by an old system, can be retrieved by new work stations.

SECMAI's SPCB [Schematics Printed Circuit Boards] software is used, among others, by Apollo for the design of its own systems. Twenty SPCB installations on VAX systems will also be operational by year-end 1984. Highly interactive, SPCB software permits the positioner to intervene during routing to reorient the routines and embodies numerous placement optimization functions, 45-degree routing, and powerful DRC [Design Rule Checking] functions.

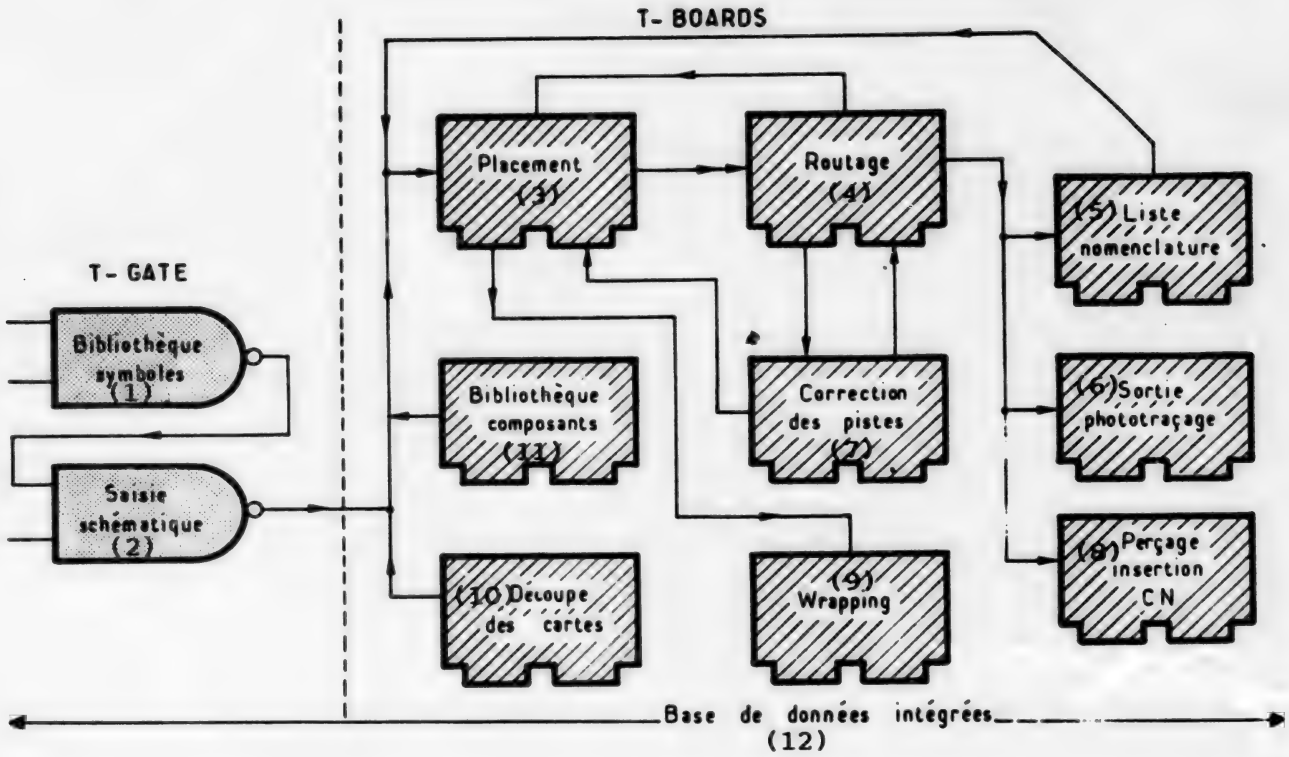
Upstream, various interfaces have been developed with simulation software packages centered on Apollo equipment; agreements have been signed in this respect with Mentor, CAE Systems and Silvar Lisco. These firms offer, for the most part, physical layout software modules, hence end-to-end solutions, for the design of VLSI's [very-large-scale integrated circuit(s)], ULA's [uncommitted logic array(s)] and hybrid circuits. SPCB will be offered to users as the "physical layout" connecting link for the printed circuit technology.

For the PMI's [Small- and Medium-Sized Industries] and design study bureaus using but not specializing in electronics, such as are found in mechanics and in robotics, SECMAI has configured a turnkey work station, dedicated to the schematics, layout and routing of printed circuits. This station, the Hurricad, a microprogrammed 16-bit machine, features highly interactive functions, a powerful router, and vocal human-machine communications functions: The Vecsys vocal input/output terminal (see ELECTRONIQUE INDUSTRIELLE No. 41) has, in fact, been incorporated into the Hurricad station. The overall cost of the station is 700,000 francs.

More generally known in connection with VLSI design, GE Calma is offering the printed-circuits market a new line of programs centered on Apollo equipment, labeled T-boards. The complete package includes: T-gate CAE software (schematics acquisition) and Tecsym software (simulation) software, which is also used in Tegastation simulation stations; an interactive routing placement software of OmniCad origin, integrated by Calma into the CAD chain; and T-scope and T-cat testing and fabrication interface modules (see diagram). A top-of-the-line station, T-boards centers around a DN 660 station, with power comparable to a VAX 11, and will be equipped in the future with a "firmware" router module of Calay origin.

As a result, the user has at his disposal modular solutions that are adaptable to his needs, and, in particular, the advantage of improved routing interactivity, be it with regard to top-of-the-line systems or closed systems such as Hurricad. This interactivity can be one response to specific problems such as the layout of analog components or other cases involving drawings. With CAD/CAM equipment undergoing change every 3 to 5 years on average, an important point is that of retrieval of data from one system to another: The acquisition of schematics on a screen with documentation provides greater guarantees in this respect than the digitization of drawings. Lastly, in cases of assemblage of modules of different origins under one integrated solution, the problem of a single prime contractor will always arise.

[Diagram follows]:



Key:

1. Symbols library.
2. Schematic acquisition.
3. Placement.
4. Routing.
5. Nomenclature list.
6. Photo-plotting.
7. Routines correction.
8. Insertion drilling.
9. Wrapping.
10. Card cutout.
11. Components library.
12. Integrated-data base.

MICROELECTRONICS

MATRA HARRIS TO FOCUS R&D ON MICROPROCESSORS

Paris ELECTRONIQUE ACTUALITES in French 26 Oct 84 pp 1, 2

[Article by J.P. Della Mussia: "Instead of the Expected Losses, MHS Will Make a Profit of FF 80 Million This Year, and It Will Redefine Its Development Orientations"]

[Text] Better than expected. Last February, Matra-Harris Semiconductors (MHS) still believed it would achieve profitability starting at the end of 1984 (see ELECTRONIQUE ACTUALITES dated 4 November 1983 and 24 February 1984). Actually, it had achieved profitability by July so that, for the year as a whole MHS will not register a loss, but a profit. As a result, the hopes of the company are becoming concrete goals: after investing FF 270 million this year, the company believes it could achieve sales of FF 600 million in 1985 (compared with FF 344 million in 1984 and FF 175 million in 1983).

Simultaneously, this year, the 3-micron technology used until now by MHS will be progressively replaced by a 1.6-micron process using 2 levels of interconnection. The company will thus be technologically ready to go through the probable crisis of 1986-1987-1988 with modern fabrication methods making it possible to manufacture circuits which will not be too much affected by price erosion.

Shareholders' Determination

The position of MHS became sound not only thanks to increased circuit prices, demand and production yields, but also thanks to the determination of its shareholders, MATRA [Mechanics, Aviation and Traction Company] and Harris, to create a sound operating climate for MHS, so that it would have every chance to succeed in its chosen way. Indeed, between October 1983 and June 1984, MATRA and Harris contributed FF 340 million in cash to the company, and gave up receivables worth FF 130 million. Therefore, the company's external debt now amounts to only FF 200 million, so that the financial expenses of MHS represent only 2.5 percent of sales. (As is known, 1983 sales amounted to FF 175 million, losses to FF 180 million and investments only to FF 50 million; during the whole first semester of this year, losses still

amounted to FF 45 million). Investments amounting to FF 270 million will be made in 1984, essentially for the doubling of production rooms and for assembly (production capacity at the end of 1985: 180,000 five-inch wafers/year). As we said, this should make it possible to achieve sales of FF 600 million in 1985, i.e. a 4-percent return on the invested capital (or 2.5 percent after taxes). That year, the engineering effort will account for 20 percent. For the period 1985-1988, the shareholders are expected to reinvest FF 1.1 billion in the operation, and sales would then reach FF 1.6 billion in 1988. The latter figure supposes an average annual rate of growth of 47 percent for CMOS [complementary metal oxide semiconductors], which is the main development orientation of MHS (in 1984, the resale of Harris products represented only 18 percent of MHS sales).

Toward Microprocessor Sales of 49 Percent

The expected growth will not occur at the same rate for all product lines in the MHS catalog, either due to a decision of MHS, as in the case of gate arrays, or due to market evolution as in the case of Intel-family microprocessors. However, MHS will continue its efforts with the selected technologies: the company expects an average annual growth of the integrated circuit market of 29 percent during the period 1983-1988; for MOS [metal-oxide semiconductors], logic circuits and CMOS circuits, which are the company's specialties, growth would be 36 percent per year. Thus, although the world market for this type of product is only $6.6 billion in 1984 (31 percent of the total), it should represent $21 billion in 1988 (over 45 percent of the total for integrated circuits).

As is known, MHS is making a special effort with respect to CMOS microprocessors: whereas the market for this type of product amounted to only $250 million in 1983 (compared with a total microprocessor market of $1.8 billion), according to MHS it should reach $1.5 billion in 1988 (out of a total of $6.5 billion).

The effort in this field will therefore be actively sustained at the (relative) expense of memories which are facing fierce competition on the market at least two years out of three. Thus, whereas memories represent 36 percent of the 1984 sales of MHS, compared with 27 percent for microprocessors, these figures will become respectively 24 and 41 percent in 1984 and probably 16 and 49 percent in 1988. Sales of other items will follow more closely the average sales pattern of the company, with the exception of bipolar [devices] whose sales would decline from 9 percent in 1984 to 3 percent in 1988:

- telecom circuits: 6 percent of sales in 1984; 9 percent in 1988;
- semi-standard circuits: 13 percent of sales in 1984; 17 percent in 1988;
- analog circuits: 9 percent of sales in 1984; 6 percent in 1988.

Another radical change should take place in the company's sales breakdown per type of market: whereas the military sector is still generating 36 percent of sales in 1984, it should generate only 16 percent in 1988, and the tilt should benefit the data-processing sector, which would increase from 18 percent this year to 37 percent in 1988. The other sectors should follow the growth of the company (from 29 to 31 percent in 1988 for telecommunications, from 15

to 11 percent for the industrial sector, and from 2 to 5 percent for the automobile sector).

Finally, the company will make an effort to export more, especially from France into Europe, where sales would increase from 35 percent in 1984 to 46 percent in 1988 (and from 9 to 14 percent in the rest of the world). In 1988, exports would thus account for 60 percent of sales.

Three-Way Cooperation on Microprocessors

Since MHS is connected to Harris for technology and to Intel for microprocessors, the present joint task of these companies as far as microprocessors are concerned is first to harmonize their technology and then to share the task of converting NMOS [n-channel metal-oxide semiconductor] devices to CMOS technology. For the time being, the CMOS technologies of Harris/MHS and Intel are not compatible. They will be next year, in 1.6-micron technology. The particular task of MHS is to convert the 8051 microcontroller to 80C51 (samples late in 1985). In 1988, the breakdown of the company's microprocessor sales should be 60 percent for CMOS and 40 percent for NMOS.

As is known, in this respect, Cimatel is designing specific circuits, essentially telecom circuits, around Intel architectures.

As far as products are concerned, the 1985 highlights for MHS will be the start of 80C86 and 80C88 production at Nantes, the introduction of CMOS 16-Kbit and 64-Kbit random-access memories, the start of production of 2,500-gate and 5,000-gate 1.6-micron 2-level gate-arrays during the second quarter, and a standard-cell circuit family (the offshoot of agreements with Bull) in the same technology.

PHOTO CAPTION

1. Page 1 MHS is now doubling its Nantes facilities by converting to facilities for 125-mm wafers. Production should thus be multiplied by 2.5 next year.

9294
CSO: 3698/204

MICROELECTRONICS

BULL OF FRANCE TO BUILD FACTORY IN SPAIN

Paris ELECTRONIQUE ACTUALITES in French 19 Oct 84 pp 1, 6

[Article signed Ph. M.: "Bull To Set Up a Plant in Spain"]

[Text] Bull and the Spanish government have just signed a draft agreement under which the manufacturer would set up a plant to manufacture office and business-communication equipment, probably in Catalonia.

This is the first such agreement signed by Bull for this type of equipment.

The draft agreement signed by Mr Lorentz, general manager of Bull, and Mr Majo, general director of the Spanish electronics industry, provides for the creation of an industrial operation and the development of new products with the participation of industrial firms linked to the CTNE (Spanish National Telephone Company) and the INI (National Industry Institute).

A plan will be developed in the next few months; it will involve the creation of a new company in which the Spanish government will have a majority interest and which will manufacture products to cover Bull's requirements in Spain, and maybe also in Portugal and Latin America.

Bull's presence in Spain, with sales of about FF 350 million in 1983, a personnel of 500, 30 distributors and 8 agencies, is rather large and increasing strongly and steadily. The agreement, which covers the Transac product line (but the specific products involved have not yet been selected) is the first agreement of this type signed by the Bull group for this line of products. For this Spanish plant, the French group appears to have abandoned its initial approach. As is known, Bull was initially negotiating with the CTNE to acquire an interest in the Telesincro company, itself a subsidiary of Secoinsa, the leading Spanish computer group which, among other things, is licensed to manufacture Fujitsu systems.

9294
CSO: 3698/199

MICROELECTRONICS

EEC, JAPAN SECRET MEETING ON STANDARDIZATION, COOPERATION

Paris LE POINT in French 15 Oct 84 pp 73-75

/Article by Martine Leventer/

/Text/ A secret meeting in Tokyo of the big names in the European and Japanese electronics industries. The objectives are to work out a modus vivendi and standardize all future products for the general public. LE POINT was there and brings you an exclusive report.

From our special envoy in Japan. It is 9:00 am, and it is like a summer day on this first Wednesday in October, in Tokyo. On the 10th floor of an austere gray building with curious, cone-shaped windows--the headquarters of Keindaren, the Japanese company--an exceptional meeting behind closed doors is beginning. Philips, Thomson, Thorn-Emi, Grundig, Bosch, Zanussi, Sony, Fujitsu, NEC, Hitachi, Mitsubishi, Matsushita, Sanyo, Sharp, Toshiba, Pioneer, JVC: there are 18 of them around a huge round table which takes up nearly the entire room. They are all presidents or vice presidents of the major European and Japanese consumer electronics firms! With them are the persons who initiated the meeting: Hikosaburo Okonogi, minister of the famous MITI, and Etienne Davignon, vice president of the EEC Commission.

It is the first time a meeting of this scope has been held. The agenda includes an exchange of views on the development of the consumer electronics industry, problems of standardization, and cooperation between Europe and Japan. It could be just another round table, if it were not for the caliber of the participants and the context.

The time is in fact critical for both sides:

--In the past few months, the Japanese have begun implementing a worldwide strategy aimed at garnering not only the video tape recorder market (that has already been done, as they have 90 percent of it!), but the market for all future consumer electronic products (stereos, video, family microcomputers, home terminals, peritelevision, security systems, etc.). They are currently conducting an offensive against the United States, which has one-third of the world market. Europe is next on their list. The closing of this market, the future potential of which they are well aware of, and the emergence of a united

and organized front on the part of European industry, which they regard as more dangerous in this field than American industry, would jeopardize their strategy.

--The Europeans are facing an immediate problem. The dam built in the form of 3-year agreements for self-limitation of exports of Japanese video tape recorders, to give the industry on the Old Continent a chance to become competitive again, has been washed away this year by a flood of Japanese machines. This flood has engulfed a recessionary market and is threatening to drown it for good.

The figures are frightening. For 1984, the self-limitation agreement was based on estimated purchases in Europe of 6.3 million video tape recorders. "The European companies for their part estimated them at no more than 5.2 million. Davignon decided to believe the Japanese!" one industry executive stormed. We now know that, with the economic crisis and the market beginning to be saturated, total consumption will barely amount to 4.5 million machines....

In these circumstances, for the Japanese to "limit" their exports as agreed to 3.9 million video tape recorders is ludicrous. With the 1 million machines manufactured by Philips and Grundig and the 1.1 million produced by the Japanese themselves in Europe, either alone or in partnership with European firms (Thomson, Thorn or Telefunken), there is more than a surfeit!

"Stocks are accumulating, prices are falling in Europe by 20 percent, and the worst is still to come if you go by Japanese forecasts for next year, which are nearly double ours!" is the complaint heard at Simavelec, the union of French manfuacturers. "Under these conditions, how do you expect to build a competitive European idnustry? Its products are not even profitable!"

"Europe is in danger of experiencing the same fate in video as it did in stereo," according to Alain Gomez, Thomson's CEO. "How can we win? When we manufacture 1 million video tape recorders, the Japanese factories produce 80 million! And yet, we cannot afford to give up. In 2 or 3 years, the video market will be as large as the color television market, which up to now has been the pillar of the consumer electronics industry."

When you talk about the collapse of the consumer electronics industry, you are talking in the long run about the collapse of the whole "chips" industry, and thus office machines and equipment. In short, the entire European electronics industry is in danger of collapsing like a house of cards. What can be done?

The self-limitation agreements have proven to be ineffective, as far as the European industrialists are concerned. They sent a report to that effect to Etienne Davignon in the spring. They showed, with figures to support them, that the EEC customs tariffs on some products should be revised upwards, and that new products should in future be temporarily protected by sufficiently high customs duties, as was already done for the famous compact disk.

"Perhaps it is nothing to be proud of, but it would be suicidal to let the Japanese plow right over us," commented Jean-Claude Bonnet, president of

Simavelec. "When the scales are tilted so far one way, you cannot have an offensive strategy without having a defensive strategy at the same time!"

A return to Tokyo on 3 October. Since the press was not invited to attend the round table--and participants are not supposed to report details of the discussions to them either--there is nothing to do but slip into the grooves! Fortunately, a number of receptions are scheduled at Keindaren and Okura, the hotel where the European CEO's are staying.

To locate Etienne Davignon during the cocktail reception scheduled before lunch at Keindaren is not so difficult: he stands head and shoulders above most of the other participants! The day before, he met for an hour at Miti with Hikosaburo Okonogi on the self-limitation agreements.

He said that he was reasonably satisfied. "The Japanese agreed to honor their commitments and to leave a specific share of the market to the Europeans. We will have to review all their exports for 1984 and 1985. This is what we are going to do next month, before renewing the agreement."

And an increase in customs tariffs? "This is another problem. We will look into this and bring it up in the Community between now and the end of the year."

5:10 pm. Applause rings out in the meeting room, and the door opens. With a very Japanese precision, the round table has come to an end. Soon the participants will be gathering together at the invitation of Akio Morita (CEO of Sony) for a dinner at Maxim's, a replica of the Parisian establishment. People are smiling: apparently, there was no confrontation. Several important Japanese executives, who have the reputation of being unapproachable, give LE POINT their impressions, in terms market by a very Oriental reserve: "We were a little afraid that the Europeans would focus on immediate problems, and particularly the problem of video tape recorders. But the meeting was actually very friendly and open, and we discussed the future, cooperation, and standardization," was the carefully-worded statement of both Shoichi Saba, president of Toshiba, and Atsuyoshi Ouchi, vice president of NEC.

On the European side, satisfaction was even expressed. "The Europeans very politely indicated, with figures to support them, that they mustn't be pushed too far, and that they could not afford to continue importing unemployment because of the heavy imbalance in their relations with Japan. Cooperation has to be a two-way street," according to Alain Gomez, who also used the same cautious terms as his Japanese counterparts.

For Peter Laister, CEO of Thorn-Emi (Great Britain), "the message has gotten through. The Japanese realize that this time the Europeans are all in that they intend to remain in the consumer electronics industry and that they expect changes in trade and cooperation between Europe and Japan."

"For the future, it is in everyone's interest not to multiply standards, contrary to what has happened with television or video tape recorders," Wisse Dekker, CEO of Philips, added. "We have therefore agreed to meet again, and to work together, through suitable structures, towards devising world standards."

The objective is for consumers throughout the world to be able to shop for their electronics products anywhere in the world and interconnect their machines without any problems. Paradise! Would everything then be for the best in this best of all possible worlds? Has the hatchet been buried and are we now moving towards a modus vivendi satisfactory for all?

One might think so in listening, for instance, to Shizuo Takano, the head of the video branch of JVC, the "champion" of the VHS, the most popular video tape recorder model. "Up to now, JVC has exported nearly half of its production of video tape recorders (some 4.5 million machines a year!) to Europe. Next year, these exports will decline. We will offset this by selling more in the United States, Asia or even Japan."

Yes, but.... At the same time, JVC is transferring its technology to the Europeans Thorn, Thomson and Telefunken. "It will take 1 or 2 years," he says, "before they are at the same level as our most advanced factory." And where will the Japanese industry be by then?

Conversely, neither NEC nor Toshiba admit that they ahve any need for the time being of European technology. What sort of "cooperation" then can we envisage?

Georges Mihaies, managing director fo the firm IIHT /International Interface in High Technology/, participated in an international study which showed that consumer electronics products which are nonexistent today will have as large a share of the world market by 1990 as the current products do.

For many of them (home terminals, stereo and video equipment, home switchbaords connected with various equipment), the German, British and French markets together frequently surpass by far the Japanese market. In other words, Europe still has a chance if....

"The Japanese worked for years to build a strategy vis-a-vis Europe. The Europeans must join forces to do the same, and devote the necessary time and resources to it, to make themselves credible. Otherwise, any cooperation with Japan is risky," George Mihaies warns.

But do the Europeans fully realize this?

9805
CSO: 3698/142

SCIENTIFIC AND INDUSTRIAL POLICY

INDUSTRIAL MODERNIZATION FUNDS AID 450 FIRMS IN FRANCE

Paris INDUSTRIES & TECHNIQUES in French 1 Oct 84 p 27

> [Text] During 9 months of operation, the FIM [Industrial Modernization Fund], managed by ANVAR [National Agency for the Implementation of Research] has already loaned Fr 4.2 billion to 450 enterprises of which 150 employ less than 500 workers. By the end of the year, there will be 1,000 of them to share 10 billion.

The FIM loaned close to 4.2 billion francs to French enterprises bewteen the time it was established in September 1983 and the end of June 1984. This means that 548 enterprises have benefitted from public savings funds (Codevi) to modernize their production facilities. By the end of the year, we will have 1,000 approved applications and we will reach a figure of FF 10 billion.

There are two criteria in determining the distribution of loans within the 16 industrial sectors surveyed: The total amount committed and the number of applications approved as of the end of May 1984. In terms of value, the transportation sector very definitely is in the lead with FF 1.5 billion committed. The IAA [agriculture and food industries] are second (FF 425 million), followed by energy and environment (FF 242 million), textiles, clothing, and shoes (FF 221 million) electronics, data processing, and office equipment (FF 183 million) and chemistry and pharmacy (FF 163 million).

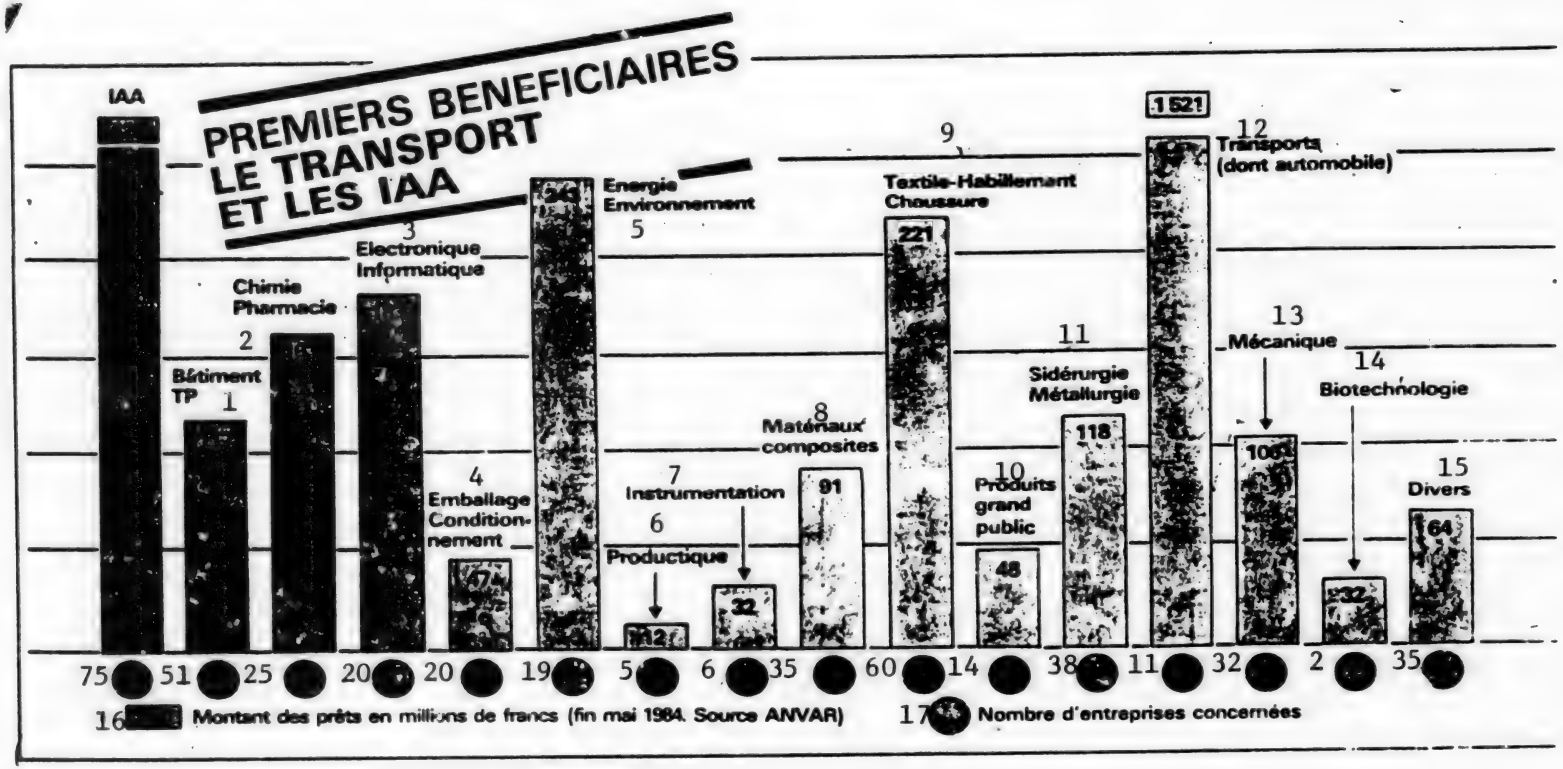
In terms of the number of cases, the IAA are in the lead (75), ahead of textiles (60), BTP [building and public works] (51), and the steel industry (38). One should note the neat breakthrough by composite materials (35 cases for a total amount of FF 90 million) and the low industrial activity level of biotechnology (2 cases with FF 31 million).

By combining these two criteria, we get typical cases which account for FF 138 million in the auto industry (FF 750 million awarded to each group under the 3 liter per 100 km vehicle program), FF 12 million in energy, FF 9.1 million in electronics, FF 3.6 million in textiles, and FF 2.5 million in composite materials.

The loans granted on the average represent half of the investments made by the enterprises. This involvement rate can be 100 percent in theory. In reality,

on the average, it comes to 70 percent in biotechnology and 30 percent in the steel industry. For all of the cases processed, it is 44 percent.

Once again, the big enterprises are benefitting more than the small enterprises from the gifts distributed by the FIM. The value of the loans in fact is inversely proportional to the size of the enterprises. Three enterprises with more than 10,000 persons are sharing FF 1.3 billion (again by virtue of the 3 liter program at Renault and PSA [Peugeot]. And 25 enterprises employing up to nine persons will get a total of Fr 19.3 million. The PMI [Small and Medium Industries] in the strict sense of the word (up to 499 employees) got a total of FF 782 million by the end of May 1984 (out of a total of FF 3.4 billion committed). There are 374 of them in this case. In other words, a standard PMI contract of Fr 2 million. In terms of regions, the North and the Pas-de-Calais are ahead of Ile-de-France, Rhone-Alpes, Aquitaine, Haute-Normandie, and Alsace.



The First Beneficiaries: Transportation and the IAA

Key: 1--Building and public works; 2--chemistry, pharmacy; 3--electronics, data processing; 4--packaging, processing; 5--energy, environment; 6--product processing; 7--instruments; 8--composite materials; 9--textiles, clothing, shoes; 10--major public products; 11--steel industry, metallurgy; 12--transportation (including autos); 13--mechanics; 14--biotechnology; 15--miscellaneous; 16--total loans in millions of francs (end of May 84, source AAVVAR); 17--Number of businesses involved.

SCIENTIFIC AND INDUSTRIAL POLICY

FRG VENTURE CAPITAL COMPANY RESTRUCTURED DUE TO LOSSES

Duesseldorf WIRTSCHAFTSWOCHE in German 9 Nov 84 pp 148, 150-152

[Text] Because the Federal Government no longer wants to carry losses, the German Venture Finance Company is being restructured. The new plan: Private-enterprise organization and maximization of profits.

For a long time now, Karl-Heinz Fanselow has needed to apply the knowledge obtained from the venture capital business to his own firm as well. "Many profitable projects can have a future only through spinoffs or buy-outs," the managing director of the German Venture Finance Company mbH (WFG) had often advised his clients. Now he himself is acting accordingly: The Federal Government has been talked into a buy-out, and the WFG has realized its spinoff through the founding of the "First Holding Company KG [limited partnership] of the WFG." The solution to funding has been found.

With that the WFG has carried out a radical restructuring--the most important motive for which nevertheless can be found above all in the fact that there were only DM 4 million left in its kitty as an equity reserve. Since the Federal Government no longer wanted to to pay its share, the only possible decision left was to continue by way of a different plan which is supposed to transform this first German venture capital company from a business with heavy losses into a highly profitable undertaking before long.

"We are incurring extremely high risks," explains Fanselow, "and are counting on extremely high profits some day." A 20-percent return would be nothing to speak of, says the head of the company. Fanselow thinks he already has an especially lucrative fish on the hook in Baden. As early as in November a contract is to be signed with a foodstuffs firm located there, which involves a sum of DM 3 million by way of a so-called co-venturing: DM 1.5 million from the WFG and the remainder from a second venture capital company, with Citibank being talked about in this connection.

This contract makes it clear that the business of the WFG has fundamentally changed:

The plan imposed by the Bonn research ministry, on promoting high-tech alone, has been abandoned simply because in this area the amortization

periods are relatively long. Even the baker of rolls receives money when he can demonstrate that his project holds out hopes of extremely high profits.

The WFG is after profit maximization, and to minimize its own risk it is giving preference to co-venturing--cooperation with other venture capital companies.

"In recent years we have learned how to properly conduct our business," rejoices Herbert Zapp, member of the board of the Deutsche Bank AG. Zapp, who has been designated as the chairman of the supervisory board of the new WFG, wants to enable the company to also have lucrative foreign business: "We will be following our firms into other countries."

The only way the new plan could be realized was without state participation. Thus the 29 interest-holders of the old WFG agreed on the dissolution of the equity-participation contract which, although it obligated the Federal Government to assume 75 percent of accruing losses--something which Bonn no longer wanted to do--on the other hand it also considerably restricted business.

The promotion of high technology became more difficult for the WFG from one year to the next. "The approach of creating new markets and new jobs by way of high-tech innovations was wrong in the last analysis," says Fanselow. Thus the Federal grants for the purpose of squaring the WFG balances grew from year to year, without producing the hoped-for results. As of 30 September 1984, the state coffers had ultimately paid out DM 35 million, and it was then that the line was drawn. The Federal Government got out--and the 29 banks put a lid on the old WFG. Thus since October the WFG Subsidiary Company mbH as well is being managed like a closed fund: Capital of DM 50 million, invested in 35 industrial managements, prospects for profits good. Because a cautious evaluation of the risks as of the end of the last fiscal year (30 September), together with the extensive utilization of the Federal contributions--75 percent--holds out the hope after all of considerable profits from disposals of holdings in the future for the 29 interest-holders of the old WFG.

"Even today," according to the WFG head, "the overwhelming majority of the businesses are in the black." With the selling of the holdings, the profits can even turn out to be hefty, because the quick write-offs will then appear as hidden reserves. Previously these write-offs have been the reason why the WFG had to show losses--although silence is being maintained about their accumulated level. Before now, with the dissolution of a holding the WFG has always taken a write-off of 40 percent.

As of right now, the private-enterprise card is being played to the hilt. The banks, each of which previously owned--and still own--over 10 percent of the old company, have founded the new German Venture Financing Company, which manages in addition to the old GmbH also the First Holding Company KG. They have already made available DM 80 million for the investment fund, and the old partners and foreign investors can pay another DM 50 million. By the end of October, the invitations for subscriptions will

have gone out. "It must be up to the banks," according to Zapp, "to establish successful venture activities on a more long-term basis."

Fanselow is in the process of greatly developing the potential of his firm. Together with Zapp, he is seeking two other managing directors, and in the next 2 years the total staff of key personnel is to be increased from a present 20 to 30. For the hard core of those managers directly involved in investment, this means a doubling to 16 staff members. The operational management company WFG will be financed through consultation fees which will arise from the fund activities. Some 4 1/2 percent of the corresponding fund amount are earmarked for personnel and non-personnel costs inclusive of outside consultants. The above-average pay for the managers--in the opinion of the fund designers--will be reflected in above-average profits from the holdings and from their sales. In this case, the management company can even hope for 15-percent dividends.

However, before profits there is the investment phase: Within the next 5 years the WFG wants to spend the DM 130 million for remunerative projects, spending between DM 20 and 30 million annually. At present, 10 projects are at the stage of detailed testing and more than double that are in preliminary testing.

In the future, the investment policy will be concentrated on holdings in those domestic and foreign companies which offer innovative products, processes, or services. Here a special role will probably be played by the branches of information and communication engineering, measuring and control techniques, robotics, new industrial materials, power engineering, environmental engineering, biotechnology, and services on the basis of and in fields related to new technologies.

In addition, Fanselow is also giving consideration to specialized businesses in which dealings with holdings rather than technology are of central interest. This might take the following form: An industry giant wants to participate in a first-rate small company whose owners cannot finance expansion any longer. But the direct way into the large concern is not suitable to the family. So the WFG offers its services as a roundabout way: The concern and the WFG investment fund each take an interest of one fourth. After 2 or 3 years the WFG sells its share to the highest bidder. In the future, such fast play with large sums of money will be practiced by the WFG at quite a hectic pace. Fanselow: "In 5 years we will have the fund of the First KG completely invested, and in 10 years we will already have sold all the holdings again." By 1990, the firms of the old WFG will also have been sold and the Second KG fund will have been set up long since. "Then private parties as well will also be invited to subscribe," stresses Zapp, who however cannot promise an admission of any WFG stock on the stock exchange. "That requires a period of incubation," he says.

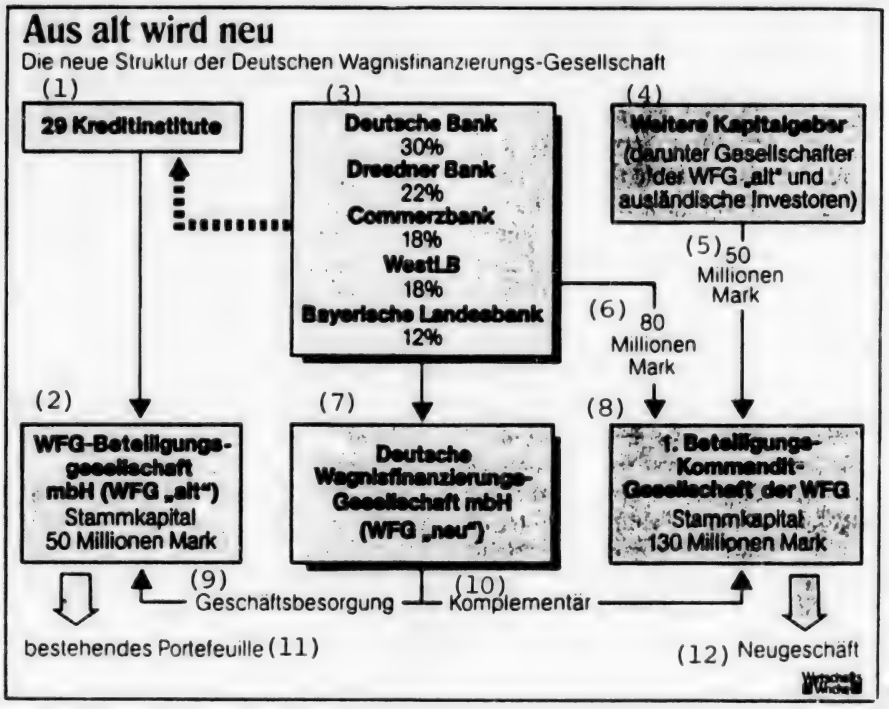


Figure 1. Something New From the Old--The New Structure of the German Venture Financing Company

Key:
1. 29 credit institutions
2. WFG Subsidiary Company mbH (WFG "old"); capital--DM 50 million
3. Deutsche Bank 30%; Dresden Bank 33%; Commerzbank 18%; West Landesbank 18%; Bavarian Landesbank 12%
4. Other capital suppliers (including members of the WFG "old" and foreign investors)
5. DM 50 million
6. DM 80 million
7. German Venture Financing Company mbH (WFG "new")
8. First Holding Limited Partnership of the WFG; capital--DM 130 million
9. Conducting of business on behalf of
10. General partner
11. Existing portfolio
12. New business

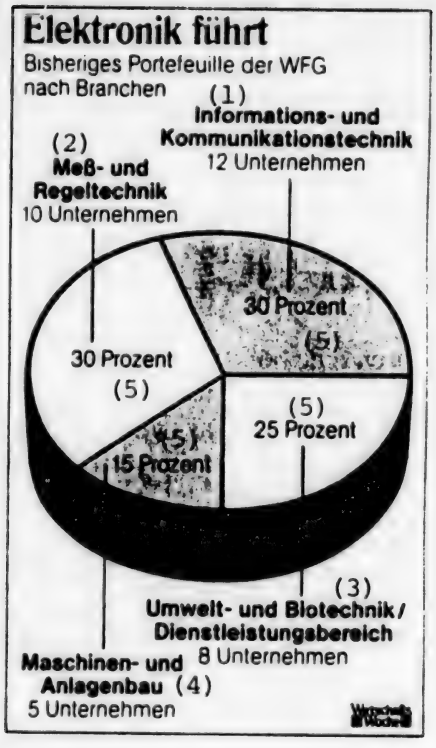


Figure 2. Electronics in the Lead--Existing Portfolio of the WFG According to Branches

Key:
1. **Information and communication engineering, 12 firms**
2. **Measuring and control technology, 10 firms**
3. **Environmental engineering and biotechnology/service sector, 8 firms**
4. **Machine and equipment construction, 5 firms**
5. **Percent**

12114
CSO: 3698/137

SCIENTIFIC AND INDUSTRIAL POLICY

FRG TO EXPAND PROGRAM TO AID NEW HIGH-TECH FIRMS

Plans Outlined

Duesseldorf VDI NACHRICHTEN in German 5 Oct 84 p 1

[Text] The model experiment on financially promoting technology-oriented businesses, which has been going on ever since the middle of last year, has been so successful that the Federal Ministry for Research and Technology has decided to expand this program of promotionalism. The intention in raising the total funds is to now make available DM 325 million for the program instead of the former DM 100 million. Among the main reasons for the great success of this promotional program was not least the rapid increase in promotional centers in the FRG and the more and more numerous technology-transfer consultation establishments.

Therefore considerable weight will also be accorded in the development program to these new promotional centers and technology parks. In doing so, at the same time the intention is to find out to what extent these newly established technology parks are suited to the founding of new companies oriented toward high technology. Projects involving biotechnology are also of interest. Up to now the bulk of the applications for assistance has definitely been in the sector of microelectronics; almost 40 percent of all applications have come from this area.

In the sector of biotechnology, now genetic engineering is to be in the center of attention above all. In this area, the Institute for Biotechnology, which is connected with the Juelich Nuclear Research Facility, will assume the handling of applications. With the new model venture-capital companies, it is also intended to give greater incentives for investments in other companies. In this connection, support on the part of the Federal Research Ministry is anticipated above all for surveys and market studies.

Further Details

Duesseldorf VDI NACHRICHTEN in German 5 Oct 84 p 10

[Article by G. H. Altenmueller: "The Federal Government Is Banking on New High-tech Firms"]

[Excerpt] The monies with which the Federal Research Ministry is supporting newly formed technology-oriented companies (TOU) are to be drastically increased. Minister Dr Heinz Riesenhuber views the model experiment which was begun a year ago as being so successful that he wants to expand it in content as well.

Previously, innovative companies were being promoted in six regions according to a three-phase scheme. Supraregionally, support is being given to TOU projects which provide for microelectronics applications, and also to those projects in whose financing equity-capital companies participate at a level of at least 25 percent. Now these are to be joined by projects in biotechnology, creations of companies within the promotional centers and technology parks, and the commitment of venture capital (VC) companies in the phase just prior to the incorporation proper. The total funds for this program, begun in July 1983, are to be increased from DM 100 to DM 325 million. Inclusion in the program is limited to a period up to the end of 1986.

The demand for such assistance is in accord with the present boom in new company creations. Riesenhuber is surprised how strong this is. However, only every tenth request will materialize as an assisted project. The 1,800 requests and applications received so far have led to 809 concept papers and proposals, of which 338 pertain to microelectronics. About three fourths of these specific plans and proposals are rejected, partly for formal, partly for subject-matter reasons (for example, an inadequate technical level). Up to now, 136 projects involving a total of about DM 20 million have been approved.

By far the largest portion of these are still in Phase I of the model experiment: Market studies, experts' reports, analysis of the patent situation, the drawing up of a management plan. Moreover, in the six regions these are being handled by technology consultation centers (mostly attached to the IHK's [Chambers of Industry and Commerce], in part also with the participation of the chambers of craftsmen), and in the sector of microelectronics by the Berlin VDI [Association of German Engineers] Technology Center. So far, 29 firms have entered into Phase II, in which as a rule they receive 75-percent non-returnable grants for the development of a prototype. In Phase III (equity participation for the purpose of loans by banks for the commencement of production and the introduction of the product in the market), so far only five projects have been assisted.

By far the majority of the present equity capital companies have been formed only in the last 6 months; therefore above all in this variant of the model experiment only two projects have been assisted so far, in contrast to the regional and the microelectronics variants with 92 and 42 projects respectively. Most of the projects in the regional variant have to do with electronics, but also a broad range of other technologies are represented, with a few projects in each case. In contrast to a widespread assumption, the bulk of the founders of these new companies is from industry (40 percent) and not from research (23 percent).

In accordance with the expansion of the program already decided on by the Federal Government, in the supraregional variant company-creation projects from the most important sectors of biotechnology are to be included: Cell-culture technology, genetic engineering, biotechnical and enzymatic processes, as well as developments in the relevant equipment. These will be handled by the Juelich Nuclear Research Facility.

Whether the numerous promoterism centers and technology parks--which already exist in part, but are mostly just now being planned or in preparation--are suitable for technology-oriented new firms is a question to be put to the test in the future within the framework of the model experiment. The Federal Laender are to designate a total of 15 centers; in these, resident companies can then be proposed for receiving assistance.

The third innovation is to offer a greater incentive to venture capital companies to become involved with TOU's. To that end, the BMFT [Federal Ministry for Research and Technology] is assuming a portion of the costs arising in Phase I for surveys and market studies which are to be assigned to outside parties. The funds are given to the venture capital companies. According to a poll by the BMFT, one reason for their great reticence about becoming involved up to now is the expensive process of selecting from among the many requests for participation, more than 90 percent of which are unsuitable.

12114
CSO: 3698/137

SCIENTIFIC AND INDUSTRIAL POLICY

BRIEFS

THOMSON MANAGEMENT CHANGES--Mr Alain Gomez, president and general manager of Thomson SA, a holding company for the entire group, including Thomson-CSF, has just appointed Mr Noel Goutard as general manager of Thomson SA and has changed the job function of certain managers. Mr Noel Goutard, deputy manager of Thomson and board member of Thomson CSF, was the group's director of operations since 1983. The industry and engineering branch includes the following companies: Thomson-Lucas, Thomson Sofragepar, Thomson Copper, Thomson Brandt, Armements, Sodeteg, and the television, instrumentation, and service equipment activities and is under Mr Goutard. Messrs Alain Bougault and Henri Starck, respectively, managers of the "equipment and systems" and "electronic components" branches at Thomson-CSF, were appointed deputy general managers of Thomson-CSF, Thomson SA affiliate. Together they will handle the management of the "equipment and systems" branch which has been "strengthened considerably." [Text] [Paris AFP SCIENCES in French 4 Oct 84 p 14] 5058

CSO: 3698/167

TECHNOLOGY TRANSFER

FRENCH FIRM 'CELLIER' DOES BIG BUSINESS WITH USSR, GDR

Paris L'USINE NOUVELLE in French Supp to 4 Oct 84 p 29

[Article by Antoine Thiboumery: "Jacques Cellier: Knowing How to Sell To East-Bloc Countries"]

[Text] He just obtained two large contracts, one in the USSR and the other in the GDR, for an amount close to his annual sales.

Double success in the East: first in Moscow last summer, then, less than one month ago, in the GDR. Cellier, an Aix-les-Bains company (Savoy), with a staff of 482, just received its two largest export contracts. Jacques Cellier, its chief executive officer and founder (in 1950) remains cool-headed.

"These two contracts, which together amount to over FF 220 million, should be compared to the sales of our company, a total of FF 242 million in 1983, not including the sales of foreign subsidiaries. Such a large sales volume could be fatal to us if we had not acquired the methods and experience necessary in the course of nearly 20 years," he acknowledges calmly.

Jacques Cellier, 59, born in Aix-les-Bains where his father owned a small scale boiler-making factory until 1950, was forced to interrupt his studies while he was preparing for admission to the National School of Engineering. He ended up taking over his father's business and learning on the job (and thoroughly) how to manage a company.

In a little over 30 years, he turned the minuscule workshop employing two people into one of the three leading companies worldwide (followed closely by one Japanese and one German company) in the fields of "turnkey" plants for the production of bi-oriented polypropylene film, as well as for paper-making machinery, nuclear equipment, handling equipment and process control.

It is an understatement to say that these two contracts with the East are not an accident. "Actually, we have been represented in the Soviet Union since 1963, when we shipped equipment for the paper industry jointly with a German company. As for East Germany, we have been supplying it directly with 'turnkey' plants for the past 15 years. And nine months ago, we placed in service a plant that makes reconstituted leather from leather scraps," Jacques Cellier goes on and on.

With all his experience of international business, he still agrees that it takes patience to deal with East European countries. "Negotiations are always very long. From one and a half to two and a half years before a contract is signed. The scenario is always the same. First, you must send a technical team for several months to obtain an accurate definition of the technical features of the machine. Then, the financiers take over with the French banker. At this stage, the negotiation is faster. Finally, you reach the last stage, when you negotiate the final price and the unavoidable compensations," he summarizes. This is where Jacques Cellier actually steps in.

It is the most difficult and the less visible part. However, the client will often ask for compensations of up to 30 percent, even 150 percent of the total project cost! "At this stage, my role is simple. I must make sure that compensations will not hinder the sale of our products on our traditional markets. Most of the time, specialized companies in France, Germany and Austria will buy back our compensations and resell them," he adds cautiously. He is equally reserved about the financial terms granted. How do you win a contract with the Russians when they demand preferential interest rates of 7.80 percent while the rates offered by French banks range only from 12.60 to 12.80 percent?

A native of Savoy, a good skier and with a passion for boating, he can also cleverly dodge a question: "Discussions on this subject are always very hard," he admits, "but they chose us, that is the main thing." Besides, he made only two very short trips to Moscow, including one to sign the contract...

Do the two large export contracts obtained by Cellier guarantee it a bright future? "The film division has a two-year backlog of orders, but that is still no reason for us to rest on our laurels," Jacques Cellier warns. "And our company must not get bottlenecked. On the contrary, we must be doubly strict in our management and provide new orientations for our commercial operations."

First consequence: the creation of a subsidiary in the FRG, Cellier GmbH, to fulfill the Russian contract, as Cellier must buy certain subassemblies from German companies.

9294
CSO: 3698/199

END

END OF FICHE DATE FILMED

19 Feb 1985